BULLER (A. H. R.)

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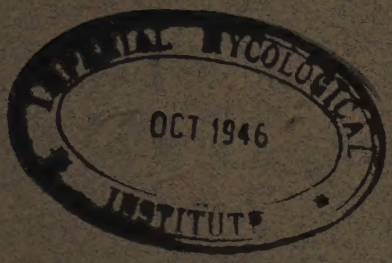

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THE FUNGUS LORE OF THE GREEKS AND ROMANS.

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EDIBLE AND POISONOUS FUNGI.

The fact that some of the larger fruit-bodies of the Higher Fungi are edible whilst others are poisonous, was doubtless discovered by Prehistoric Man far back in the dim distance of the remote past, probably more than one hundred thousand years ago. Hunger and curiosity are strong motives, and either would have been sufficient to prompt our ancestors of the Stone Age to experiment on the food values of the fleshy Basidiomycetes.

There is an abundance of evidence afforded by classical literature[1] that the Greeks and Romans were well acquainted

(1) Works containing references to the classical literature of fungi are: J. J. Paulet, *Traité des Champignons,* Paris, Tome 1, 1793, pp. 1-21; H. O. Lenz, *Botanik der alten Griechen und Römer,* Gotha, 1859; C. D. Badham, *A Treatise on the Esculent Funguses of England,* London, 1863; and E. Roze in Richon and Roze, *Atlas des Champignons,* Paris, 1888. The most systematic collection of references in the English language is that made by W. Houghton called *Notices of Fungi in Greek and Latin Authors,* Annals and Magazine of Natural History, Series 5, Vol. 15, 1885, pp. 22-49. Of the materials gathered together in this excellent paper and of the translations I have made free use; but in addition I have referred to a number of passages in the Classics which Houghton did not mention. Except where otherwise stated, all references given in this chapter have been verified from the original sources, and where it has been found necessary, revised translations have been given. In the work of translation, I have had the invaluable help of my friend, Mr. W. B. Grove, who is both a mycologist and a master of the classical languages. My colleague, Frederick W. Clark, Professor of Greek and Latin, has also been good enough to read over my manuscript and to give me the benefit of his criticism.

with the gastronomic qualities of such fungi as Truffles, Boleti (our Amanitae), Puff-balls, and Mushrooms. Indeed, in their days of luxury, the wealthy Romans seem to have developed a passion for these delicacies. Thus Pliny,[2] in his observations on the cooking of fungi, remarks that fungi are "the only food which dainty voluptuaries themselves prepare with their own hands and thus, as it were, by anticipation feed on them, using amber knives and silver service"; whilst Juvenal's contempt for the practice is shown in one of his Satires,[3] in which he says: "Nor will that youth allow any relative to hope better of him who has learnt to peel truffles and to pickle boleti." Special vessels for cooking boleti were known as *boletaria*, and these were not supposed to be used for any inferior purposes. Martial,[4] in an Epigram, represents one of these vessels as lamenting its changed function in a Roman kitchen: "Although boleti have given me so noble a name, I am now used, I am ashamed to say, for Brussels sprouts." In another Epigram, the same poet[5] says: "Gold and silver and dresses may be trusted to a messenger but not boleti." Obviously, one is to infer that on the way the fungi might prove too great a temptation and the man might cook them and eat them. Suetonius[6] states that the emperor Tiberius gave Asellius Sabinus 200,000 sesterces (*circa* £2,000) for composing a dialogue in which boleti, beccaficos, oysters, and thrushes were represented as contending for the honour of being the best food. Coelius Apicius,[7] in his work called *De Arte Coquinaria Libri Decem*, in discoursing upon the arts of the kitchen, tells us how Boleti, Tubera, and other fungi may be cooked. It is evident from his recipes that diverse condiments were often added to the dishes.

(2) Pliny, Natural History, Delphin. ed., XXII., 47.
(3) Juvenal, Sat. XIV., 6-8.
(4) Martial, Ep. XIV., 101.
(5) *Ibid.* XIII., 48.
(6) Suetonius, Tib. cap. XLII. Beccaficos are small birds much esteemed as dainties in the autumn when they have fattened on figs and grapes. *Vide* Murray's English Dictionary.
(7) Coelius Apicius, De Opsoniis et Condimentis, sive de Arte Coquinaria Libri Decem, ed. 2, by Martin Lister, 1719, pp. 208-211. It is believed that the original work was compiled in the third century A.D. (Encyclopaedia Britannica, article Apicius).

Apicius mentions four different kinds of fungi as being prepared for the table: *Fungi farnei* (conjectured by some to be our *Boletus edulis*); *Boleti* (our *Amanita caesarea*); *Tubera* (Truffles); and *Sfonduli, Funguli,* or *Spongioli* (believed to correspond to the *Spongiole* of Porta, 1592, and the modern Italian *Spugnola,* the name of *Morchella*). The following are the recipes as translated by Houghton from the edition of C. T. Schuch, 1874, pp. 154-156 (Houghton, *loc. cit.*, p. 47. I have altered the word *peel* to *slice* in the first recipe for Tubera in deference to a criticism by Tulasne in his *Fungi hypogaei).*

For cooking *Fungi farnei:* (1) Boil them, dry hot, and serve with wine-sauce *(oenogarum)* and pepper pounded with liquor. (2) Use

The practice of giving extravagant banquets grew to such an extent at a late period of the Roman Republic that from time to time sumptuary laws were passed to prevent the use of certain expensive articles of animal diet. But no restrictions were placed upon the products of the soil. The result was, as Cicero[8] tells us, that those fond of the table devised means of cooking vegetable food so as to make it as tasty as possible. He says: "While these elegant eaters wish to bring into high repute the products of the soil which are not included in the Act, they prepare their fungi, helvellae, and all vegetables with such highly seasoned condiments that it is impossible to conceive anything more delicious." Cicero also says that in his own case the law proved to be a fraud, for, after partaking of some of these dishes at a supper given by the augurs at the house of Lentulus, he was seized with such violent diarrhœa that for ten days he was hardly able to stand. He had abstained from oysters and eels in obedience to the law, but not from highly seasoned vegetables: "I who willingly abstained from delicate fishes, found myself taken in by vulgar herbs." He ends his letter with a reflection which many another has made under like circumstances: "After this I shall be more cautious." The passing of the sumptuary laws was probably one of the reasons why the eating of fungi became so popular in the time of the Roman Emperors.

Some of the rich Greeks appear to have been just as fond of the luxuries of the table as the Romans, for Plutarch,[9] in his

pepper, sweet boiled wine *(caroenum)*, vinegar, and oil. (3) Another recipe: boil in salt and serve with oil, wine, and pounded coriander seed.

For *Boleti:* (1) Pour over them sweet boiled wine and add a bunch of green coriander and serve. (2) Another recipe: serve their stalks in liquor with salt. (3) Place the cut-off stalks *(tirsos)* on a dish, pour echinus eggs (?) *(uvam)* over them with pepper, lovage, a little honey, and oil.

For *Tubera:* (1) Slice, boil, sprinkle with salt, and transfix with a twig *(surculo infigis)*; partly roast, and place in a cooking-vessel with oil, liquor, sweet boiled wine, unmixed wine, pepper and honey; while boiling, beat up with fine flour, take out the twigs and serve. (2) Another recipe: boil and sprinkle salt, transfix with twigs, partly roast, place in a cooking-vessel with liquor, oil, greens, sweet boiled wine, a small quantity of unmixed wine, pepper, and a little honey, and let it boil; while boiling beat up with fine flour; prick the tubers that they may absorb, take out the twigs and serve. If you like you may surround the tubers with the omentum of a pig, then roast and serve.

Four other recipes for cooking Truffles are given, the ingredients not mentioned in the above recipes being mint, rue, leeks (?), cummin, seseli, and parsley. Apicius gives several recipes for cooking *Spongioli (Morchella)* which do not differ in any particulars from those he gives for serving *Fungi farnei* (*vide* p. 65 of Schluch's edition).

(8) Cicero, Ad. Fam. VII., 26. Letter to Gallus.

(9) Plutarch, De Tuenda Sanitate Praecepta, Vol. II., p. 124, F, ed. Xylander; *cf.* also the translation of Plutarch's Works, published by T. V. Crowell and Co., Vol. V., Rules for the Preservation of Health, p. 602.

Rules for the Preservation of Health, discourses upon the folly of the former in indulging in costly meats and drinks. He particularly mentions as articles of luxury: "sow's udders, Italian mushrooms (*μυκήτων Ἰταλικῶν*), Samian cakes, and snow in Egypt."[10] The use of the expression "Italian mushrooms" warrants us in believing that edible fungi were sometimes exported from Italy into Greece.

The tragic consequences which may sometimes result from the accidental eating of poisonous species of fungi, were as well known to the old Greeks and Romans as to ourselves. Thus, according to Eparchides,[11] when Euripides (480-406 B.C.) was on a visit to Icarus, a certain woman, with two full-grown sons and an unmarried daughter, gathered some deadly fungi from the fields, and all the family partook of them and died. Whereupon, the poet made the following Epigram: "O Sun, that cleavest the undying vault of heaven, hast thou ever seen with thine eye such a calamity as this—a mother and maiden daughter and two sons destroyed by pitiless fate in one day?"

Hippocrates[12] (born *circa* 460 B.C.), the Father of Medicine, relates that the daughter of Pausanias, having eaten a raw fungus, was seized with nausea, suffocation, and pains in the stomach. She was given hydromel to drink and was put into a hot bath. In the bath she vomited up the fungus, and, as the trouble passed off, perspired profusely.

To the poet Martial[13] is attributed an Epigram on the death of Macrinus in which there are two rather grim puns on the names of fungi:

> *Defungi fungis* homines, Macrine, negabas;
> *Boleti leti* causa fuere tui.

(10) Houghton and others read "snow *from* Egypt." This is a wrong translation. Snow does not fall in Egypt, but compressed snow or ice might have been brought there sometimes from the mountains of Asia Minor or Southern Europe.

(11) Eparchides, *apud* Athenaeus, Deipnosoph. II., 57.

(12) Hippocrates, Epidemicorum, lib. VII., §102. The patient of Hippocrates may have eaten the fungus raw through thoughtlessness or ignorance. It was usual for the Greeks and Romans, as we learn from the writings of Pliny, Apicius, etc., to cook their fungi. Truffles, however, were an exception, for Dioscorides (Mat. Med. II., 174, *sec.* Houghton) tells us that these were eaten "either raw or cooked." At the present day, fungi are universally cooked by civilized people. However, according to Charles Darwin, the Fuegians of Patagonia sustain themselves on *Cyttaria Darwinii* (one of the Pezizineae), which they devour in the raw state. Darwin says that this fungus "has a mucilaginous, slightly sweetish taste, with a faint smell like that of a mushroom," and remarks that, so far as he knows, "Tierra del Fuego is the only country in the world where a cryptogamic plant affords a staple article of food" (Journal of Researches During the Voyage of H.M.S. "Beagle," Chap. XI.).

(13) *Vide* Martial, ed. Delphin., Vol. II., p. 1074.

"You were wont to deny, Macrinus, that men could be killed by fungi; yet Boleti were the cause of your own death."

Harmless fungi were sometimes made the instruments of the vilest deeds. The most celebrated instance is the murder of Claudius Cæsar by his wife Agrippina, which, according to Pliny,[14] Suetonius,[15] and Tacitus,[16] was accomplished by adding poison to a dish of edible Boleti[17] of which the unsuspecting Emperor partook. Some said that the poison was prepared by Locusta and others that it was placed in the dish by Agrippina's own hands. Claudius, after his death, was deified, notwithstanding that by violent deeds he had rendered himself an object of loathing to the people. In the sarcastic words of Juvenal, "he descended into heaven."[18] Nero, who succeeded him and was doubtless privy to the plot, was audacious enough to make no secret of the manner in which Claudius had been poisoned; for, quoting a Greek proverb (*Βρῶμα Θεῶν*), he used to declare that Boleti were *food of the gods*. This was obviously a joking allusion to the apotheosis of his predecessor.[19]

Again, Pliny[20] states that the Suilli (probably *Boletus edulis*) are very convenient for poisoning (venenis accommodatissimi), and as he adds that they caused the death of Annaeus Serenus, the prefect of Nero's guard, together with a number of tribunes and centurions at a banquet, it seems likely that the fungus was used as a medium for introducing some poison of a foreign nature into the dish in which it appeared at table.[21]

Fungi were divided into edible and poisonous kinds by Dioscorides,[22] the celebrated Greek writer on medicine, who lived in the first century A.D. This gastronomic system of classification was followed by many of the Herbalists whose first works were simply commentaries upon Dioscorides. Owing to its popular appeal and practical utility, it has survived to the present day and is now embodied in scores of books published in various languages.

The leading authorities on medicine among the ancients looked upon the consumption of fungi with grave suspicion; firstly, because they knew of so many cases of accidental

(14) Pliny, Nat. Hist., XXII., 46.
(15) Suetonius, Claudius, 44.
(16) Tacitus, Annals, Translation by Church and Brodribb, 1906, Book XII., 66 and 67.
(17) Most probably our *Amanita caesarea, vide infra.*
(18) Juvenal, Sat. VI., 622-623.
(19) Suetonius, Nero, §33. For the Greek proverb *cf.* Houghton, *loc. cit.*, p. 37.
(20) Pliny, Nat. Hist., XXII., 47.
(21) *Cf.* Houghton, *loc. cit.*, p. 33, where this view is discussed at length.
(22) Dioscorides, Mat. Med., IV., 83.

poisoning, and, secondly, because the edible kinds were often eaten to such excess that they gave their patients indigestion. Dioscorides stated that even the good kinds "if partaken of too freely, are injurious, being indigestible, causing stricture and cholera," and he suggested that an emetic should be taken after the meal of which they formed a part.[23] He would have applauded Pliny's question "What so great pleasure can there be in such doubtful food?"[24] Galen (born A.D. 130), whose opinions on medicine became so celebrated in after years and who was so often quoted by the Herbalists of the sixteenth and seventeenth centuries, treated of fungi from the strictly medical point of view. He held that fungi in general are unwholesome, and deprecated their consumption. He advised people not to touch anything but the Boletus *(Amanita caesarea)* and the Amanita *(Psalliota campestris)*, and even concerning the former, notwithstanding the popular verdict, he had nothing good to say. These are his words: "Of fungi *(μύκης)* the Boletus *(βωλίτης)*, when well boiled, must be counted among insipid things; it is generally eaten with various kinds of spices, as is done with other insipid food. These fungi, after being eaten in large quantities, yield cold, clammy, noxious juices as their nourishing qualities; the Boleti are the most harmless, and after them the Amanitae *(ἀμανῖται)*; as for the rest, it is far safer to have nothing to do with them."[25] In his work on *The Good and Bad Juices of Foods*, he says: "Of all such kinds of food, fungi have the coldest, most viscid, and thickest juice; however, among them the Boleti have never been known to cause anyone's death; still, to some persons, even they cause cholera and indigestion."[26] Notwithstanding all these words of wisdom and the weight of Galen's authority, the public was not prepared to forego the pleasure of eating various kinds of fungi. The later works of Athenaeus[27] and Diphilus[28] inform us that, in the second and third centuries A.D., cases of fungus-poisoning still continued to occur, and that there were still folks who ate of the edible sorts so immoderately that they were punished with all the pangs of indigestion.

THE DAWN OF MYCOLOGY.

It seems natural enough that the first interest of man in fungi should have been connected with his food supply. However, as civilization advanced, men began to reflect upon

(23) Dioscorides, *Ibid.*
(24) Pliny, Nat. Hist. XXII., 47.
(25) Galen, De Aliment. Facult., lib. II., 69.
(26) Galen, De Probis Pravisque Alimentorum Succis, *cap.* IV., p. 770.
(27) Athenaeus, Deipnosoph. II.
(28) Diphilus is quoted by Athenaeus, *loc. cit.* II., 61, d.

and to discuss the nature of plants and animals from a more detached standpoint. Thus Solomon, who reigned from about 971-931 B.C., "spake of trees from the cedar tree that is in Lebanon even unto the hyssop that springeth out of the wall; he spake also of beasts and of fowl, and of creeping things, and of fishes."[29] The "kings of the earth" came to hear his wisdom, but as to whether or not his discourses included fungi, we have no evidence.[30]

The first references to fungi in classical literature were made in the fifth century B.C., and are those of Euripides and Hippocrates, each of whom, as we have seen, record a case of accidental poisoning, the one from the point of view of a poet and the other from that of a medical man. In addition, however, Hippocrates mentions that fungi (probably *amadou*, the German tinder of commerce) were used for cauterization in certain complaints. To this matter we shall return in a later section.[31]

The first philosophical reflections on the nature of fungi are those of Theophrastus, the famous pupil of Aristotle (*circa* B.C. 300). Unfortunately he seems to have assumed that his readers were well acquainted with the species to which he was referring, and he has therefore not described his fungi sufficiently for identification. He[32] speaks of the *μύκης* and the *ὕδνον* as having neither root, stem (*καυλός*), branch, bud, leaf, flower, nor fruit; again neither bark, pith, fibres, nor veins. Later, however,[33] he speaks of the stem (*καυλός*) of the *μύκης* as having a certain uniform structure or evenness. He[34] also says that the *ὕδνον*, *μύκης*, *πέζις*, and *κεραύνιον* have no root. He[35] adds that the *μύκητες* grow out of and near the roots of oaks and other trees, and, in his treatise on odours, notes[36] that the *μύκητες* which grow on dung have no bad smell. Evidently, Theophrastus, finding

(29) Solomon, I Kings IV., 33.

(30) Indirect references to fungi not improbably are to be found in Leviticus, chaps. XIII. and XIV. It seems likely that the leprosy which caused baldness of the head and beard, was brought about by a parasitic fungus. The leprosy of the house may have been caused by *Merulius lacrymans* or some other wood-destroying fungus; but the evidence on this point, in my judgment, is not very clear. The phrase "hollow strakes, greenish or reddish," does not seem applicable to *Merulius lacrymans*. The blight of corn, mentioned several times in the Old Testament, may have been due to a Rust fungus (*Cf.* Eriksson und Henning, Die Getreideroste, ihre Geschichte, etc., Stockholm, 1896). There is no reference in the Bible to such fungi as Mushrooms and Truffles.

(31) *Vide infra:* "Fire Made with Fungus Tinder," p. 46.

(32) Theophrastus, Hist. Plant., I., 1, §11, ed. Teubner.

(33) *Ibid.* I., 5, §3.

(34) *Ibid.* I., 6, §5.

(35) *Ibid.* III., 7, §6.

(36) Theophrastus, De Odoribus, Frag. IV., 1, §3, ed. Teubner

that the Fleshy Fungi are so different in appearance from the Higher Plants, was puzzled to give them a description, and solved the problem by setting out a list of negative characters. These first recorded observations on the nature of fungi, few though they are, may be considered as registering the beginning of the study of the morphology of fungi and the dawn of mycology.

In order to find out what the fungi are which Theophrastus mentions, it is necessary to compare what later Greek and Roman writers, such as Pliny and Athenaeus, say about them. As a result of proceeding in this way, the conclusion has been arrived at that *μύκης* was the Greek name for fungi in general excluding Truffles; that *ὕδνον* was the general name for Truffles *(Tubera);* that *κεραύνιον* was a particular kind of Truffle; while *πέζις* was the name for a Puff-ball, possibly of *Lycoperdon Bovista* Linn.[37] It is not unlikely that the fungi *(μύκητες)* which "grow on dung" and "have no bad smell" were fruit-bodies of *Psalliota campestris*, the Common Mushroom, for these are easily observed when they come up on stable manure, and possess a distinctly pleasant odour. On the other hand, the philosopher may have had in mind the common coprophilous species of *Coprinus* and *Panaeolus*.

There can be no doubt that the Romans considered fungi as among the commonest objects of life long before the beginning of the Christian era. This is proved by the fact that Plautus, the great comic dramatist of ancient Rome, who flourished at the end of the Third Century B.C., refers to fungi in the colloquies of his plays in the most familiar manner. Thus, in his *Trinummus*, when old Charmides, without being seen, has observed the entrance of the sycophant who wears a hat with a very broad brim, he makes Charmides exclaim: "By Pollux, he's just like an Agaric: he's completely covered by his head!"[38] The slave Sangarinus is made to say, in his last speech in the *Stichus*, that it is just as impossible for him to have too much dancing as it is for a mushroom to have too much rain.[39] Further, in the *Bacchides*, in the fourth act, Plautus makes the slave Chrysalus ridicule his old master Nicobulus. Chrysalus says: "He has been travelling up and down this earth, a perfect nuisance; he has neither sense nor

(37) *Cf.* Lenz, *loc. cit.*, p. 755; and Houghton, *loc. cit.* pp. 43, 48, etc. *Vide infra.*

(38) Plautus, Scriptorum Classicorum Bibliotheca Oxoniensis, Oxonii, Comoediae, Trinummus, IV., 2, 9: "Pol hicquidem fungino generest: capite se totum tegit."

(39) Plautus, *loc. cit.*, Stichus, V., 7, 5-6: "Nunc pariter ambo. Omnis uoco cinaedos contra. | Satis esse nobis non magis poti' quam fungo imber."

feeling; he's no more good than a rotten fungus!"[40] In the second act, Nicobulus complains to Chrysalus of Archidemides, and says *not* "Wasn't I a *fool* to trust him!" *but* "Wasn't I a *fungus* to trust him!";[41] and, in the fifth act, in a burst of self-denunciation, he says: "Of all the persons here in the world or already dead or yet to be born, who are fools, blockheads, idiots, *fungi*, dullards, drivellers, and babblers, I, quite by myself, surpass them all in my folly!"[42] Evidently the word *fungus*, like the word ass with us had come to be used in a derisive sense.[43]

THE FIRST KNOWN ILLUSTRATION OF A FUNGUS.

To the Romans we must go back for the first illustration of a fungus which has come down to us. In the first year of the reign of Titus, 79 A.D., occurred the famous eruption of Vesuvius which buried Herculaneum and Pompeii in lava and ashes, and thus preserved to us so many precious relics of Roman civilization. Excavations in Pompeii have brought to light, on the walls of public and private buildings, some 2,000 frescoes, of which a certain number represent people, objects, and scenes in the immediate neighbourhood. Into these mural decorations, plants were sometimes introduced. Most of them are Phanerogamia, but in one picture there are several fruit-bodies of one of the Agaricineae. Comes, who wrote a book on the plants depicted at Pompeii, has identified the fungus as *Lactarius deliciosus*. Comes also holds that this species is the one referred to by Pliny where he says that "the safest fungi are those whose skin becomes red, but a less dilute red than that of the Boleti (fungorum . . . . tutissimi, qui rubent callo, minus diluto rubore quam boleti)."[44]

(40) Plautus, *loc. cit.*, Bacchides, IV., 7, 23-24: "Terrae (iam) odium ambulat; iam nil sapit, | Nec sentit; tanti 'st quanti 'st fungus putidus."

(41) Plautus, *ibid.* II., 3, 49: "Adeon me fuisse fungum ut qui illi crederem."

(42) Plautus, *ibid.* V., 1, 1-2: "Quiquomque ubi sunt, qui fuerunt quique futuri sunt posthac | Stulti, stolidi, fatui, fungi, bardi, blenni, buccones, | Solus ego omnis longe antideo stultitia et moribus indoctis."

(43) There is another possible reference in Plautus to fungi, namely, in the *Curculio*, V., 2, 13-14, in which Therapontigonus says to the Parasite: "Quin tu is in malam crucem | Cum bolis, cum bullis?" *Cum bolis, cum bullis* is the reading in the Oxford edition. According to Roze (*loc. cit.* p. V.), this was the reading of Robert-Estienne in 1530; but Lambin in 1576 read *cum boletis, cum bulbis*, a version adopted by Naudet. If this latter reading could be relied on, it would afford evidence that the famous *boletus (Amanita caesarea)* was known long prior to the time of Pliny.

(44) O. Comes, Illustratione delle piante nei dipinti pompeiani, Napoli, 1879, p. 9. According to Comes, the fruit-bodies are represented in the painting No. 102 of the Museo nazionale, and this painting is reproduced in the *Pitture di Ercolano e contorni*, Napoli, 1757, Vol. II, t. 56. Another reproduction is given by E. Saglio in the article on *Cibaria*, Dictionnaire des Antiquités, Grecques et Romaines, Paris, now in course of publication. Seven or eight fruit-bodies are shown lying together after being picked. The sketch is in black-and-white.

THE RUST DISEASE.

Doubtless the cultivated plants of the Greeks and Romans often suffered from diseases which must have seemed highly mysterious in their origin. Among these diseases was certainly the Red Rust of Wheat and other cereals, for mention is made of it by Aristotle, Theophrastus, Strabo, Varro, Columella, Ovid, and Pliny.[45] Pliny several times refers to Rust, which in one passage he calls "the greatest pest of the crops."[46] He tells us that many people say that it is caused by the sun heating the dew, but he gives it as his opinion that it is produced by frost.[47] He further says that Rust is averted "by fixing branches of laurel in the fields, for then the Rust passes over to the laurel leaves."[48] It is difficult to imagine what could have led to this useless practice.

The Romans had a festival every Spring called the Robigalia (Rubigalia), which was celebrated for the purpose of warding off the *robigo* (rad. *robus*=*ruber*, red), which was the Latin name for Rust. Pliny says: "The ancients feared three periods of the year for their crops, on account of which they instituted feasts, the Rubigalia, the Floralia, and the Vinalia. The Rubigalia were instituted by Numa in the eleventh year of his reign, and they are now celebrated on the twenty-fifth of April, since at that time the Rust generally attacks the corn."[49] The object of the Robigalia was to propitiate the god Robigus, who was supposed to have the power of warding off the Rust disease. The Quirinal flamen presided over the ceremony, and the procession marched out from Rome to the *lucus Robigi*, situated at the fifth milestone along the Claudian way. There in the sacred grove, before a crowd clad in white togas, the priest offered up a prayer to the stern Rust-god, imploring him to spare the crops of Ceres, a libation of wine was poured upon the altar, incense was thrown into the flames, and the entrails of a sheep and of a dog were placed on the altar and burnt.[50] The dog was reddish,[51] this colour being symbolical of the pest to be averted.[52] Ovid, once, when returning to the capital from the neighbouring town of

(45) *Cf.* Eriksson und Henning, Die Getreideroste, Stockholm, 1896, pp. 7-11.
(46) Pliny, Nat. Hist., XVIII., 46.
(47) *Ibid.* XVIII., 68.
(48) *Ibid.* XVIII., 46.
(49) Pliny, Nat. Hist., XVIII., 69.
(50) Ovid, Fasti, IV., 905.
(51) Festus, ed Müller, p. 285 (*sec.* Fowler): "Rufae canes immolabantur, ut fruges flavescentes ad maturitatem perducerentur."
(52) This is the view of Mannhardt. Frazer says that the colour of the dog was supposed to resemble not the Red Rust but the corn which it was desired to bring to its golden perfection. Fowler says either or both of these views may be correct. *Vide* A. W. Fowler, The Roman Festivals of the Period of the Republic, London, 1899, p. 91.

Nomentum, met the Robigalian procession by chance, and it is to his pen that we are indebted for an account of the rites which were performed by the priest.[53] To-day, the children of men still worship many strange gods; but Robigus, the stern Rust-god, is not among them. The besom of science has stretched even to high Olympus and has ruthlessly swept him into the dust-bin of oblivion.

THE ORIGIN OF FUNGI.

Concerning the origin of fungi, the Greeks and Romans entertained only the vaguest ideas. In particular, the coming into existence of Truffles seemed to be one of the marvels of nature. Of course the mycelium which we now know gives rise to them, must usually have escaped notice and, even if observed, its function could scarcely have been suspected. Pliny[54] says: "Among the most wonderful of all things is the fact that anything can spring up and live without a root. These are called Truffles (tubera); they are surrounded on all sides by earth, and are supported by no fibres or only by hair-like root-threads (capillamentis); nor does the place in which they are produced swell out into any protuberance or present any fissure; they do not adhere to the earth; they are surrounded by a bark, so that one cannot say they are altogether composed of earth, but are a kind of earthy concretion; they generally grow in dry sandy places which are overgrown with shrubs; in size they are often as large as quinces, and weigh as much as a pound. There are two kinds: one is sandy and injures the teeth, the other is without any foreign matter (sincera); they are distinguished by their colours being red, or black, or white within; those of Africa are most esteemed. Now whether this imperfection of the earth (vitium terrae)—for it cannot be said to be anything else—grows, or whether it has at once assumed its full globular size, whether it lives or not, are matters which I think cannot be easily understood. In their being liable to become rotten, these things resemble wood."

One of the opinions current among the ancients was that Truffles are formed during thunderstorms. The pages of Plutarch[55] contain a long and curious dissertation on the question: "Why Truffles are thought to be produced by thunder." At a supper in Elis, some very large Truffles were set upon the table. After everybody had admired them, one

(53) For other references to the Robigalia *cf.* the article on *Robigalia* by J. Hild in the *Dictionnaire des Antiquités Grecques et Romaines,* Paris, now in course of publication.

(54) Pliny, Nat. Hist., XIX., 11.

(55) Plutarch, Symposiaca (Table Talk), Book IV., Question 2. *Cf.* The Complete Works of Plutarch, T. Y. Crowell and Co., New York, Vol. VI., pp. 215-217; also Houghton, *loc. cit.*, p. 45.

of the guests remarked with a smile: "These are worthy of the late thunder," thereby meaning to deride those who think that Truffles are produced by thunder. This precipitated a general discussion on the origin of Truffles. The host Agemachus stood up stoutly for the generally accepted opinion, and in ending his defence said: "It is absurd to wonder at these things when we see the most incredible things imaginable in thunder, as flame arising out of moist vapour and from soft clouds such deafening noises." The view finally accepted was that Truffles grow by means of a certain generating fluid (*ὕδωρ γόνιμον*) contained in the thunder, which being mixed with heat, pierces into the earth and there produces the tubera. It was also held that Truffles do not resemble plants, and although they are nourished by rain, nevertheless have neither root nor shoot, and are quite free and independent, the earth having been altered and changed in substance. Juvenal[56] also refers to the influence of thunderstorms on Truffles in the description of a feast, in which he says: "Before him there smokes the liver of a big goose, fit to be eaten by geese, and a boar's head, worthy of the sword of the yellow-haired Meleager. After this Truffles will be handed round if it is spring and if the longed-for thunders have produced the precious dainties."

From some remarks of Theophrastus[57] (*circa* 300 B.C.), it appears that in his time not all the Greeks were content with the belief that Truffles are produced by thunder. He says: "With regard to these things, peculiar beliefs are held, for they say that they are produced during autumn rains, and thunderstorms especially, which are the main reason of their growing, and that they do not last more than a year, and are best for food in the spring. Some think they are produced from seed, because those which grow on the shore of the Mityleneans only appear after floods, which bring down the seed from Tiarae, where many *ὕδνα* are found. They grow on the shore where there is much sand. They are found around Lampsacum of Abarnis, and in Alopeconnesus (Asia), and in Elis." In this passage, we find the first reference to seeds as the possible origin of fungi. There is not the slightest reason, however, to believe that the ancients thought that fungi in general arise from seeds. We are safe in supposing that Phanias, who wrote a book on plants, represented the opinion of his day when he stated that Fungi (*μύκης*) and Truffles (*ὕδνον*) are like Ferns (*πτερίς*) in that "they produce neither bloom nor any trace of generation by buds or seeds."[58]

(56) Juvenal, Sat. V., 116-119.

(57) Theophrastus, Hist. Plant., I., 6, §13, ed. Schneider, *sec.* Houghton. This passage is quoted in Athenaeus, Deipnosoph., II., 62, b, c.

(58) Phanias was one of the writers quoted by Athenaeus, A.D. 230 (Deipnosoph. II., 56-59).

That the Greeks and Romans took notice of the lamellae of the Agaricineae is shown by the fact that they mistook certain simple corals which have radiating calcareous plates, for fungi turned to stone;[59] but there is nothing to suggest that the ancients ever observed the spore-dust which the hymenium gives forth. Doubtless it was nothing more than a witty sally when Petronius,[60] in his Satyricon, in describing the extravagant tastes of the gourmand Trimalchio, said that the latter had written to India in order to have some seed of the Boletus sent to him.

The physician and poet Nicander (*circa* 185 B.C.) refers to a fungus as being "the evil ferment of the earth." The following translation from his hexameter poem called the *Alexipharmaca*, in which he treats of poisons and their antidotes, will serve to show how fact and fable mingled in his mind.[61] "Let not the evil ferment of the earth which often causes swellings in the belly or strictures in the throat, distress a man; for when it has grown up under the viper's deep hollow track, it gives forth the poison and hard breathing of its mouth; an evil ferment is that; men generally call the ferment by the name of fungus (*μύκης*), but different kinds are distinguished by different names; but do thou take the many-coated heads of the cabbage, or cut round the twisting stems of the rue, or take the efflorescence which has accumulated on old corroded copper, or steep the ashes of clematis in vinegar, then bruise the roots of pyrethrum, adding a sprinkling of dye or soda, and the leaf of cress which grows in gardens, with the medic plant and pungent mustard, and burn wine-lees or the dung of the domestic fowl into ashes; then, putting your right finger in your throat to make you sick, vomit forth the baneful pest."

THE SEXES OF AGARICUM.

Dioscorides[62] speaks of certain fungi as differing in sex. Thus in discussing the Agaricum, to which he attributed important medicinal properties, he says: "One kind is male, the other female, which differs from the male in having straight fibres within: the male is roundish in form and of the same texture throughout; in taste both kinds are similar, at first sweet, then, after being in the mouth a little time, bitter. It grows in Agaria of Sarmatia; some people say that it is the root of a plant, others that it is produced like fungi (*μύκητες*) in the trunks of trees that have become rotten; it grows also

(59) We owe this interesting deduction to Houghton, *loc. cit.* p. 41. *Cf.* the later section on "Stone Fungi."

(60) Petronius, Cena Trimalchionis, 38. *Cf.* Petronius (Trimalchio's Banquet), translation by M. J. Ryan, Scott Publishing Company, p. 14.

(61) Nicander, Alexipharmaca, 521-536.

(62) Dioscorides, De Med., III., 1.

in Asia, namely in Galatia and Cilicia, on cedar trees, but it is of a friable and weak nature." From the description of Dioscorides, it seems reasonable to believe that his female Agaricum corresponds to the *Polyporus officinalis* of the old pharmacopoeias and of modern mycology.[63] This fungus, according to Fries,[64] grows on larches in subalpine places in Southern Europe. The "straight fibres within" were doubtless the hymenial tubes. But what was the male Agaricum which was "roundish in form and of the same texture throughout"? Evidently, Dioscorides had but a very imperfect idea of the nature of the Agaricum, or he would not have mentioned that some people regard it as a root and others as a fungus; and he may not have been aware that the plant existed in two forms, that freshly gathered and that prepared for commerce. Commercial Agaricum, according to Paulet,[65] used to consist of fruit-bodies with the upper scaly crust and the lower layer of hymenial tubes removed, i.e., of the homogeneous sporophore flesh only. It seems likely, therefore, that the male Agaricum of Dioscorides was simply the fruit-body of *Polyporus officinalis* in the commercial state,[66] and that the two forms of Agaricum were called male and female simply as a means of distinguishing them.[67] On this view the supposition that in the first century of the Christian era it was believed that certain fungi interacted in some way so as to bring about sexual reproduction, may be dismissed from our minds.

(63) There are several synonyms for this fungus. After the reform of nomenclature by Linnaeus in his *Species Plantarum* of 1753, it was called *Boletus Laricis* Jacq. in 1778; *Boletus officinalis* Vill. in 1789; *Boletus purgans* Pers. in 1801; and *Polyporus officinalis* Fr. in 1821. With the introduction by Gillet in 1878 of the generic name Fomes for perennial species of Polyporus, the *Polyporus officinalis* Fr. became converted into *Fomes officinalis*. The American, Murrill, who wrote his systematic account of the Polyporaceae shortly before the rules of fungus nomenclature were formulated at an international congress at Brussels in 1910, goes back beyond Fries to the earliest specific name of the Linnaean type and calls the fungus *Fomes Laricis* (Jacq.) Murrill (*Cf.* W. A. Murrill, North American Flora, Vol. IX., p. 99).

(64) Fries, Hymenomycetes Europaei, Upsaliae, 1874, p. 555. In North America the fungus is found on a number of conifers in a region extending from New Mexico to Canada. It occurs on several species of Pine (*Pinus ponderosa, P. murrayana, P. lambertiana*), on the Douglas Spruce (*Pseudotsuga taxifolia*), and on the Larch (*Larix occidentalis*). *Vide* G. G. Hedgcock, Notes on some Diseases of Trees in our National Forests, Washington, 1914, p. 2.

(65) Paulet. Traité des Champignons, Paris, Tome I., 1793, pp. 10 and 501.

(66) *Cf.* Paulet, *loc. cit.*

(67) The sex names *mas* and *femina* were frequently employed before the time of Linnaeus for distinguishing between allied species. Linnaeus himself, in his *Philosophia Botanica* (1751, p. 214), protested against this erroneous nomenclature. At the same time he gave a list of twenty-one genera (Filix, Orchis, Veronica, etc.) in which it had been used. The popular names *Lady Fern* and *Male Fern* still serve to distinguish two distinct species.

THE MEDICINAL PROPERTIES OF FUNGI.

Dioscorides evidently believed that the Agaricum was a most powerful agency in curing disease. Continuing the passage quoted in the foregoing paragraph, we find that the fungus is endowed with the most astonishing medicinal virtues: "Its properties are styptic and heat-producing, efficacious against colic *(στρόφους)* and sores, fractured limbs, and bruises from falls; the dose is two obols weight with wine and honey to those who have no fever; in fever cases with honeyed water; it is given in liver complaints, asthma, jaundice, dysentery, kidney diseases where there is difficulty in passing water, in cases of hysteria, and to those of a sallow complexion, in doses of one drachma; in cases of phthisis it is administered in raisin-wine, in affections of the spleen with honey and vinegar. By persons troubled with pains in the stomach and by those who suffer from acid eructations, the root is chewed and swallowed by itself without any liquid; it stops bleeding when taken with water in three-obol doses; it is good for pains in the loins and joints, in epilepsy when taken with an equal quantity of honey and vinegar; it assists menstruation and relieves flatulence in women when taken with equal proportions of honey and vinegar. It prevents rigor if taken before the attack; in one- and two-drachma doses, it acts as a purgative when taken with honeyed water; it is an antidote in poisons in one-drachma doses with dilute wine. In three-obol doses with wine it is a relief in cases of bites and wounds caused by serpents. On the whole, it is serviceable in all internal complaints when taken according to the age and strength of the patient; some should take it with water, others with wine, and others with vinegar and honey or with water and honey."

The Agaricum was not the only fungus believed by the ancients to possess medicinal properties, as may be learnt from the remarks of Pliny[68] about the *Suilli*, which several writers, *e.g.*, Paulet,[69] Lenz,[70] and Houghton,[71] have identified with our *Boletus edulis*: "Glaucias thinks that Boleti are good for the stomach; Suilli are dried and hung up, being transfixed with a rush, as in those which come from Bithynia. These are good as a remedy in fluxes from the bowels, which are called *rheumatismi*, and for fleshy excrescences of the anus, which they diminish and in time remove; they remove freckles (lentiginem) and blemishes on women's faces; a healing lotion is also made of them, as of lead, for sore eyes; soaked in water

(68) Pliny, Nat. Hist., XXII., 47.
(69) Paulet, Traité des Champignons, Tome I., 1793, p. 15.
(70) Lenz, *loc. cit.*, p. 760.
(71) W. Houghton, *loc. cit.*, *p.* 32.

they are applied as a salve to foul ulcers and eruptions of the head and to bites inflicted by dogs." Most people have not the slightest conception of the difficulties of pharmacological experiment: they do not appreciate how hard it is, in the absence of strictly comparative observations, to decide whether or not any specific chemical compound administered through the mouth, is really beneficial in any particular kind of illness. If, when taking a certain kind of medicine, they get well, there seems to be a natural tendency to conclude that the medicine has "done them good," notwithstanding the fact that in most cases of illness they would recover if they took no medicine at all. Then, too, the ignorant and the weak love to pin their faith to the dicta of certain men and to certain well-recommended drugs. No doubt by so doing, an optimistic feeling is created which has its curative value; and in some cases, indeed, so-called faith-cures may be effected. Human nature does not alter much even in the course of ages. The factors which induce people at the present day to demand bottles of medicine from their doctors and to purchase quack medicines in such vast quantities, were doubtless at work in the times of the old Greeks and Romans. There is therefore no difficulty in accounting for the belief of the ancients that they could cure the most diverse diseases with *agaricum* and *suilli*, which are now rightly regarded as of little value.

The use of Agaricum has persisted from the time of Dioscorides down to the present day. It is still mentioned in the Pharmacopoeias, but is stated to be unofficial.[72] There seems to be no doubt that, as a powder in larger doses, it acts as a drastic purgative,[73] and that, in smaller doses in the form of *agaricin*, an alcoholic extract, it checks excessive perspiration.[74] Agaricin appears to have the same general pharmacodynamical action as atropine, but to be weaker in its effects.[75] Large doses cause diarrhœa, vomiting, and death through central paralysis.[76] It acts on the sebaceous glands, and hence has been used for inhibiting night-sweats in cases of phthisis.[77] Badham,[78] writing in 1847, tells us of the application of Agaricum for the cure of consumption: "The *Polyporus laricis* [*P. officinalis*], the so-called Agaric of pharmacy, is a powerful but most uncertain medicine, and has also been

(72) T. Sollman, A Text-book of Pharmacology, London, 1906, p. 466; also Potter, Materia Medica, Pharmacy and Therapeutics, ed. IX., Philadelphia, 1903, p. 118.

(73) Potter, *loc. cit.* The drug is called *Agaricus albus, White or Purging Agaric.*

(74) Potter, *loc. cit.*; Sollman, *loc. cit.*, pp. 240 & 466. This author refers to the drug as *Agaricin* from *Boletus laricis.*

(75) (76) & (77) Sollman, *loc. cit.*, p. 240.

(78) C. D. Badham, A Treatise on the Esculent Funguses of England, London, ed. I., 1847; ed. II., 1863, p. 26.

recommended for consumption. I once administered a few grains of it in this disease, when violent pains and hypercatharsis supervened, which lasted for several hours. MM. B. Lagrange and Braconnot found it to contain a large quantity of an acrid resin, to which it no doubt owes its hypercathartic properties. To judge from this single case, which, however, tallies with the experience of others, I should say that the fungus was, in medicine, to be looked upon as a very suspicious ally." These references to modern writers show us that the old Agaricum is endowed with positive pharmacodynamical properties, and that in consequence the belief of the ancients in it was based to some extent on definite experience and not mere fancy. However, that Dioscorides grossly exaggerated the medicinal value of the drug there can be no doubt whatever. No one would now use it for epilepsy, the bites and wounds of serpents, or generally for all internal complaints. The small amount of use to which Agaricum or its extract is put at the present day appears to be due to the fact that for cases in which it is effective, other drugs which act more powerfully, such as belladonna and camphor, have been substituted.(79)

(79) In more recent times, several kinds of fungi, in addition to the Agaricum, have been employed in medicine. The use of Ergot of Rye *(Claviceps purpurea)* in childbirth dates from the middle of the sixteenth century (Frank, Krankheiten der Pflanzen, ed. II., vol. II., Breslau, 1896, p. 468). The ancients, apparently, did not know of its value. It was believed by the Herbalists (e.g., Gerarde, Herball, London, 1636, p. 1584) that the Jew's Ear Fungus *(Hirneola Auricula-Judae)* was a remedy for sore throats. The so-called *Fungi cervini (=Elaphomyces granulatus)* used to be regarded (*vide* Cordus, Annotationes, 1540, published 1561; also J. Bauhin's Historia, 1651, lib. XL.) as aphrodisiacs, and love-potions were made from them. Badham, who was a medical man and evidently very proud of his profession, tells us (Esculent Funguses of England, 1847, ed. II., 1863, p. 25) of the supposed value of *Trametes suaveolens* Fr. in the cure of consumption. He says: "Another fungus, formerly much in fashion, though now put on the shelf, seems really to deserve further trial; I mean *Polyporus suaveolens* (Linn.), which in that most intractable disease, tubercular consumption, surely claims to be tried when there are such respectable authorities to vouch for its surprising effects, in cases where everything else had been notoriously unsuccessful. Sartorius was the first to prescribe it as a remedy in phthisis, and its employment with this view, since his day, has at various times been praeconized on the Continent; the dose being a scruple of the powder two or three times a day." He then cites the case of a young man who had the symptoms of consumption and was supposed to have been cured by treatment with the fungus: "A teaspoonful of an electuary of the *P. suaveolens* was given him three times a day, and *nothing else;* and extraordinary as it may appear, under this treatment the sweats speedily began to diminish with the cough, and after a three months' continuance of the medicine the patient entirely recovered." This belief of Badham and others in *Trametes suaveolens* is very similar to that of Dioscorides in the *Agaricum.* The new sciences of Bacteriology and Pharmacology have had an enormous effect on the treatment of disease. Drugging with fungi for consumption, etc., has now become unthinkable.

ORIGIN OF POISONS IN FUNGI.

So far as the origin of fungus poisons is concerned, Nicander, in a passage already quoted, was the first to express an opinion which has come down to us. He ascribed the poisons to the breath of venomous serpents. Dioscorides[80] held similar views, for he says: "Fungi have a two-fold difference, for they are either good for food or poisonous; their poisonous nature depends on various causes, for such fungi grow either amongst rusty nails or rotten rags, or near serpents' holes, or on trees producing noxious fruits." Pliny,[81] following the Greek writers, says: "Noxious kinds must be entirely condemned; for if there be near them a hob-nail (caligaris clavus), or a bit of rusty iron, or a piece of rotten cloth, forthwith the plant, as it grows, elaborates the foreign juice and flavour into poison; who could discern the different kinds, except country-folk and those who gather them? Moreover they imbibe other noxious qualities besides; if, for instance, the hole of a venomous serpent be near, and the serpent breathe upon them as they open, from their natural affinity with poisonous substances, they are readily disposed to imbibe such poison. Therefore it will be well to exercise care in gathering them until the serpents retire into their holes." Of course, we now know that the poisons of fungi, *e.g.*, phalline, muscarine, etc., are not absorbed directly from without, nor are they manufactured from specific juices taken in from exterior substances, but they arise within the fruit-bodies owing to the metabolic activity of the protoplasm in the hyphae. To discover this, however, was not a simple matter, and it is, therefore, not surprising that the old Greek folk-lore about the nails and serpents' holes, etc., should have persisted for ages. Even some of the Herbalists repeat it without comment, and Matthiolus (1560) goes so far as to add two serpents in his general illustration of fungi.[82]

TESTS FOR DISTINGUISHING BETWEEN EDIBLE AND POISONOUS FUNGI.

The belief that there are one or more simple tests for distinguishing between edible and poisonous fungi, as all mycologists know, is widely held at the present day. However, its extreme antiquity is shown by the fact that Diphilus, a physician who lived about the beginning of the third century B.C. and who wrote a book on *Diets Suitable for Persons in Good and Bad Health*, says: "The wholesome kinds appear

(80) Dioscorides, Mat. Med., IV., 83.
(81) Pliny, Nat. Hist. XXII., 47.
(82) Matthiolus, Commentarii in libros sex Pedacii Dioscoridis Anazarbei de medica materia. Several editions. The illustration of fungi with the two serpents in the edition 1560 is reproduced by Agnes Arber in Herbals, their Origin and Evolution, Cambridge, 1912, p. 185.

to be those which are easily peeled, are smooth and readily broken, such as grow on elms and pines; the unwholesome kinds are black, livid, and hard, and such as remain hard after boiling; such when eaten produce deadly effects."[83] Dioscorides[84] says that poisonous fungi "have a thick coating of mucus, and when laid by after being gathered, quickly become putrid, but others not of this kind impart a sweet taste to sauces." Pliny[85] says: "Some persons have discriminated the kinds of fungi from the kinds of trees on which they grow, such as those found on the fig, the fennel (ferula), and gummiferous trees. We have already spoken of those which are produced on the beech, the oak, or the cypress. . . . All the poisonous fungi have a livid colour," and further, "Those kinds which remain hard after cooking are injurious, while those which admit of being thoroughly well cooked, when eaten with saltpetre are harmless." Horace,[86] in a line often quoted by the Herbalists, says: "Fungi which grow in meadows are the best; it is not well to trust others." It is hardly necessary to state that these tests, of which that of the peeling skin is believed in by many even at the present day, have no true basis in fact: they are not generally applicable and upon them, therefore, no reliance can be placed. The only way to discriminate between fungi which are edible and those which are poisonous is to learn the characteristics of the individual species.

Pliny, in addition to giving general rules for distinguishing poisonous and edible fungi, did indeed refer to certain species as being safe. These were: (1) the *boletus*, which, as we shall shortly see from his description, was undoubtedly *Amanita caesarea*, (2) the fungus which has "a red skin but of a darker hue than occurs in boleti" which Lenz [87] has conjectured to be *Russula alutacea* and Comes[88] *Lactarius deliciosus*, (3) the fungus which is "white, whose stalk closely resembles the apex of a Flamen's cap," which Houghton[89] believes to be *Coprinus comatus*, and (4) the *suilli*, which Paulet and others have identified (I think correctly) with *Boletus edulis*.

REMEDIES FOR EATING POISONOUS FUNGI.

As a remedy for the effects of eating poisonous fungi, the Greeks and Romans rightly recommended an emetic. Already Nicander's complicated mixture has been cited.[90] Among his

(83) Quoted in Athenaeus, Deipnosoph., II., 61, d.
(84) Dioscorides, Mat. Med., IV., 83.
(85) Pliny, Nat. Hist., XXII., 47.
(86) Horace, Sat. II., 4, 20.
(87) Lenz, *loc. cit.*, p. 760.
(88) Comes, *loc. cit.*
(89) Houghton, *loc. cit.*, p. 32.
(90) Nicander, *Vide supra* "The Origin of Fungi," p. 33.

ingredients were vinegar and the dung of the domestic fowl, a curious antidote which long remained in vogue. Some 300 years after the time of Nicander, we find Galen, the celebrated physician of Pergamus (born A.D. 130) saying: "I have heard of a physician of Mysia who administered fowl's dung to persons suffering from fungus poisoning, and I myself have often experimented with the remedy. I have used finely powdered dung mixed with water or with honey and vinegar. The patients immediately on drinking the mixture vomited and recovered. One must observe that the dung of a fowl at liberty is more efficacious than that of one in confinement."[91] Dioscorides appears to have been suspicious of all fungi, for he went so far as to recommend that an emetic should be taken after eating even apparently wholesome kinds. One of the alternatives offered is bird's dung and vinegar. Writing of edible fungi he[92] says: "Even these, if partaken of too freely, are injurious, being indigestible, causing stricture and cholera. As a safeguard, all should be eaten with a draught of olive oil and soda or lye-ashes, with a decoction of salt and vinegar or savory, with marjoram, or they should be followed with a draught composed of birds' dung and vinegar, or with a linctus of much honey; for even the edible sorts are difficult of digestion and generally pass whole with the excrement."

In the Geoponica,[93] a compilation of which neither the author nor the exact date is known, but which may have been produced about 900 A.D., it is said that if any one has eaten a poisonous boletus, he should take as a remedy the juice of the cabbage. In another place myrtle berries are recommended as an excellent remedy against poisonous fungi. Nicander, as we have seen, advised the addition of "the many-coated cabbage" to his emetic, so that the use of the cabbage in cases of fungus poisoning may have lasted for a thousand years. Instead of cabbage, Celsus,[94] who lived about the time of Augustus and Tiberius, prescribed radishes, for he says: "If anyone shall have eaten of noxious fungi, let him eat radishes with vinegar and water (posca) or with salt and vinegar."

That the ancient physicians, like those of the present day, were occasionally called in to attend patients suffering from the effects of eating unwholesome fungi, is shown by the words of Galen, already quoted, in which he says that he had often used the emetic containing fowl's dung. In dealing with a

(91) Galen, De Simplicium Medicamentorum Temperamentis et Facultatibus, IV., p. 303, ed. Kühn.

(92) Dioscorides, Mat. Med., IV., 83.

(93) Geoponica, Translated into German by D. M. Herren and called *Der Feldbaw oder das Buch von der Feldarbeyt,* Strassburg, 1551, p. 156, (lib. XII.).

(94) Celsus, De Med., V., 27, 17.

special instance of poisoning, he[95] says: "I myself know the case of a man who ate a quantity of these insufficiently cooked boleti, supposed to be wholesome, and was afterwards troubled with severe pains in the stomach, with difficulty in breathing, faintness, and cold sweats, and who was with difficulty saved by taking such remedies as are able to dissipate inspissated juices, such as vinegar and honey, either alone or boiled for a time with hyssop and marjoram; the man partook of this remedy sprinkled with soda, and vomited up the fungi which he had eaten."

ATTEMPTS TO NEUTRALIZE THE POISONS OF FUNGI.

The ancients appear to have believed that the poisons of fungi might be neutralized by special modes of preparing the fungi before they were eaten. Thus Celsus[96] says that noxious fungi "can be rendered serviceable by a mode of cooking them; for if they have been boiled in oil or with the young twig of a pear-tree, they become free from any bad quality"; and Pliny[97] remarks that fungi "are rendered more safe still if they are cooked with meat or with pear stalks; indeed, it is good to eat pears immediately after fungi. Vinegar being of a nature contrary to them neutralizes their dangerous qualities." The Romans and Greeks were on the right track in this matter, for we now know that there are means of preparing even the most deadly fungi so that they may be eaten with impunity. The toxic substances in fungi are soluble. Paulet,[98] in his *Traité des Champignons*, published in 1793, pointed out that if poisonous fungi are cut up into pieces and steeped in water containing either salt, vinegar, or alcohol, the poison passes out of them, and they are rendered harmless to animals which are fed on them. It was left, however, to another Frenchman, Frédéric Gérard to give a conclusive demonstration that even such death-dealing fungi as *Amanita phalloides* and *A. muscaria*, if suitably prepared, can be eaten by human beings without any ill effects. Gérard,[99] in a memoir which he sent to the

(95) Galen, De Aliment. Facult., lib. II., cap. 69.
(96) Celsus, De Med., V., 27, 17, *sec.* Houghton, *loc. cit.* p. 26.
(97) Pliny, Nat. Hist. XXII., 47.
(98) Paulet, Traité des Champignons, Paris, 1793, Tom. 2, p. 25.
(99) Gérard published an account of his experiments in Quesneville's *Revue scientifique* in 1850 and 1851. His memoir was republished in Quesneville's *Moniteur scientifique* in 1861, and again by Figuier in his *Année scientifique* (6. année). I have not been able to gain access to any of these publications. However, Figuier has given an excellent account of Gérard's experiments and the report of the commission in his *Histoire des Plantes*, ed. III., Paris, 1880, and it is from this source that my facts are taken. Patouillard in his *Des Champignons au point de vue de leurs Charactères Usuels, Chemiques, et Toxicologiques*, Paris, 1866, also quotes Gérard and states that he has successfully repeated the experiments with poisonous fungi upon animals.

Conseil de Salubrité of Paris in 1851, asserted that he and his family had eaten all kinds of poisonous fungi unscathed. The *Conseil* appointed a commission of three to test this assertion. In the presence of this commission, Gérard prepared and ate on one day 500 grams (1lb. 1·5oz.) of *Amanita muscaria*, and on another 70 grams of *Amanita phalloides*, without the slightest signs of poisoning. The method of preparing the repast was as follows. The poisonous fruit-bodies were cut up into several large pieces, which were washed and left to soak for two hours in a litre (1·75 pints) of water, to which had been added two spoonfuls of vinegar. At the end of this time, the pieces of fungi were taken out of the water, washed under the tap, and then placed in fresh water, where they were boiled for half-an-hour. After this they were washed for a last time in cold water and then wiped dry. Finally they were got ready for the table in the ordinary manner and eaten. The commissioners, two of whom ventured to taste small pieces of the fungi, were quite satisfied with the results of the experiments, and they reported the success which had attended them to the *Conseil*. In giving an account of his researches, Gérard stated that he and his family had eaten more than 75 kilograms of poisonous fungi within a month.(100) Since Gérard's demonstration before the commission at Paris, all doubt as to the possibility of safely eating poisonous fungi has been removed.

Gérard showed that dangerous fungi can be rendered safe even without the use of salt or vinegar by treating them with water alone. In this case, the fungi are first soaked in cold water for two hours, during which time the water is changed twice or thrice; they are then washed and placed in cold water, which is gradually raised to the boiling point; they are then boiled for half-an-hour, after which they are again washed in cold water. As soon as this has been accomplished, they are ready for special preparation as a table-dish, for the poisonous substances have been carried away in the water which has been used for soaking, boiling, and washing.

According to Henri Fabre, the "Homer of the Insect," the

(100) Gérard's instructions for preparing poisonous fungi were as follows: "For every 500 grams of fungi cut up into pieces of medium size a litre of water is required which has been acidulated with two or three spoonfuls of vinegar, or to which two spoonfuls of salt (sel gris) has been added, if one has not got anything else. If one has water only at one's disposal, it is necessary to renew it two or three times. One allows the fungi *to soak for two complete hours*. Then one washes them in plenty of water. They are then put into cold water, which is raised to the boiling point. After half an hour, one takes them out, washes them again, one wipes them, and one prepares them as a special dish. Needless to say that all the water which has been used to wash the fungi, must be thrown away." Figuier, *loc. cit.* p. 297.

peasants of Sérignan, in the South of France, regularly eat many poisonous and doubtful species of fungi, among which he names *Boletus Satanus* Lenz, *B. purpureus* Fr., *Amanita pantherina* DC., *A. citrina* Schaeff., and *Armillaria mellea* Fr. Fabre himself often also indulged in this suspicious food. And yet he says: "During the thirty and more years that I have lived at Sérignan, I have never heard of one case of mushroom-poisoning, even the mildest, in the village." He explains this absence of accident as follows: "In my village and for a long way around, the rule is to blanch the mushrooms, that is to say, to bring them to the boil in water with a little salt in it. A few rinsings in cold water conclude the treatment. They are then prepared in whatever manner one pleases."(101) It is stated in various works that the people of Russia, Poland, and Hungary prepare all kinds of fungi for the table in a similar manner.(102)

We can now return to Celsus and Pliny. In the light of the facts just brought forward, it seems to be a fair conclusion that Celsus was referring to a practice essentially similar to that now employed by the peasants of Sérignan when he stated that noxious fungi "can be rendered serviceable by a mode of cooking them; for if they have been boiled in oil or with the young twig of a pear-tree, they become free from any bad quality." Pliny simply states that "vinegar being of a nature contrary to fungi neutralizes their dangerous qualities." In view of the demonstrations of Gérard, it seems sufficiently probable that in this sentence the great naturalist was referring to the soaking of doubtful fungi in acidulated water as a stage in their preparations for the table. The secret of rendering dangerous fungi harmless may have been known among the ancients only to groups of peasants in various localities. That it was not known universally appears to be shown by the numerous references in classical literature to cases of fungus-poisoning.

(101) J. Henri Fabre, The Life of the Fly, English translation by A. T. de Mattos, Toronto, 1913, pp. 415-425. In his pithy way, Fabre says: "When it leaves the purgatory of the stewpan, the doubtful mushroom can be eaten without fear" (p. 424). He thus comments on the results of boiling fungi: "But this you will tell me, is a system of cookery fit for savages: the treatment with boiling water will reduce the mushrooms to a mash; it will take away all their flavour and all their succulence. That is a complete mistake. . . . Prolonged boiling . . . left them very nearly intact. . . . In the second place there is no loss of succulence and hardly any of flavour. Moreover they become much more digestible, which is a most important condition in a dish generally so heavy for the stomach. For this reason, it is the custom, in my family, to treat them one and all with boiling water, including even the glorious imperial (*Amanita caesarea* Fr.)."

(102) E. Boudier, Des Champignons au point de vue de leurs Charactères Usuels, Chimiques, et Toxicologiques, Paris, 1866, p. 94.

THE BOLETUS OF THE ROMANS.

Pliny, in his Natural History, discoursed at some length on fungi. He was the first to give so good an account of a species of the Boletus of the Romans that we are enabled to identify the fungus with some certainty. Doubtless he was thinking of the species of Amanita whilst writing the passage about to be quoted. His poisonous kinds may have been *Amanita muscaria*, *A. pantherina*, etc., but his description of the edible kind fits *A. caesarea*, a conclusion accepted by Lenz,[103] Badham,[104] and Houghton,[105] and which is supported by tradition. Pliny writes: "Among those things which are rashly eaten I shall rightly place *boleti*, excellent food no doubt, but which have been brought into reproach by an unparalleled instance; for by their means, poison was administered to the Emperor Tiberius Claudius by his wife Agrippina, by which deed she inflicted another poison on the world, and especially on herself, in the person of her own son Nero. Some of the poisonous kinds are known by a dilute red colour (diluto rubore), a loathsome aspect, and internally by a livid hue; they have gaping cracks (rimosa stria) and a pale lip round the margin. But these characteristics are not seen in certain kinds which are dry and like nitre, and which bear on their heads, as it were, white spots formed from their own coating; for the earth first produces a wrapper (volva) and afterwards the fungus itself within the volva, like the yolk in an egg; the young boletus with its volva is very good for food. As the boletus grows, the volva is burst; by and by its substance is borne on the stem; there are seldom two heads on one stem. Their origin is from mud and the acrid juices of moist earth, or frequently from those of acorn-bearing trees; at first it appears as a kind of tenacious foam (spuma lentior), then as a membranous body; afterwards the young boletus appears. . . . The whole existence of a boletus from birth to death is not more than seven days."[106] From this description, it seems clear that the *boletus* of the Romans was an Amanita, namely, *A. caesarea*, and that therefore it was a gilled fungus and quite different from the Boletus of modern mycology, which is provided with hymenial tubes. *Amanita caesarea* does not occur in England but is common in Italy. Bicknell[107] says that it is offered for sale in the markets of Milan, Bergamo, Brescia, Verona, Cremona, Bologna, and other Lombard cities, from the middle of September to the middle of October, and that it is everywhere called *uovolo*.

(103) Lenz, *loc. cit.*, p. 759.
(104) Badham, *loc. cit.*, p. 2.
(105) Houghton, *loc. cit.*, p. 30.
(106) Pliny, Nat. Hist., XXII., 46.
(107) A. S. Bicknell, Notes on the Edible Fungi of Italy, Woolhope Club Transactions, 1884, p. 249.

According to Lenz,[108] the modern Italian names of the fungus are *uovolo*, *uovolo ordinatio*, *uovolo commune*, and *uovolo rancio* (orange-coloured). The name *uovolo* fits in with Pliny's words "like the yoke in an egg," and is very appropriate, as may be seen from the coloured illustrations of the young fruit-bodies when they are bursting through the volva, published by Krombholz,[109] Harzer,[110] and Richon and Roze.[111] Lenz[112] also says that at Verona the fungus is called *fongo ovo*, *fongo bolado*, and *bolè*, and remarks that in the two latter names the ancient name *boletus* still survives.

Paulet, in 1793, stated that in several cantons of Languedoc, where a number of Latin words had survived almost unchanged, *Amanita caesarea* (l'oronge) was called *un bolet*,[113] and further, that, in some parts of France where the Romans had established themselves, this fungus was still known by the name of *boulés*, which is evidently a survival from the Latin *boletus*.[114]

THE CULTIVATION OF FUNGI.

The Mushroom *(Psalliota campestris)* was doubtless known to the Romans, and was probably included by Horace[115] under the name of Meadow Mushrooms, which he said were the best. However, there is no reason to suppose that the Romans cultivated the Mushroom, for, if they had, such writers as Pliny would certainly have referred to the practice. The cultivation of Mushrooms from spawn probably did not take place before the beginning of the seventeenth century. My investigations seem to show that the art first arose in France, probably in the neighbourhood of Paris. The first scientific description of it was given by Tournefort[116] in 1707.

The Greeks and Romans appear to have known a method of growing the Poplar Fungus or *Pholiota aegerita*, a species which is much more common in Italy than in France or England.[117] The accounts of the practice which have come down to us seem rather imperfect, and are evidently given at second hand. Dioscorides[118] says: "Some people say that the bark of the white and black poplar cut into small pieces and scat-

(108) Lenz, Botanik der alten Griechen und Römer, Gotha, 1859, p. 753.
(109) Krombholz, Schwämme, Prag, 1831, Taf. 8.
(110) Harzer, Pilze, Dresden, 1842-45, Taf. 80.
(111) Richon et Roze, Atlas des Champignons, Paris, 1888, Pl. 2.
(112) Lenz, *loc. cit.*, p. 753.
(113) Paulet, Traité des Champignons, Paris, Tome I., 1793, Introduction, p. XIII.
(114) *Ibid.* Part I., p. 13.
(115) Horace, Sat. II., 4, 20 and 21. *Pratensibus* optima *fungis* Natura est; aliis male creditur.
(116) Tournefort, Observations sur la Naissance et sur la Culture des Champignons, Mém. l' Acad. Sci. de Paris, 1707, pp. 58-66.
(117) Richon et Roze, Atlas des Champignons, Paris, 1888, p. 65.
(118) Dioscorides, Mat. Med., I., 109.

tered over dunged spaces will produce edible fungi at all seasons." In the *Geoponica*, a late work, already referred to as having been published possibly about the year 900 A.D., and which contains precepts concerning rural economy, we read: "In order to make fungi grow, one must saw off the stump of a black poplar and pour sour dough dissolved in water upon the cut pieces. Black-poplar fungi soon appear."(119) It seems doubtful whether or not the dough would assist in the infection of the wood unless by keeping its exposed surface moist and thus providing a suitable condition for the germination of the spores.

Another recipe for obtaining fungi is also given in the *Geoponica*, and is as follows:—"If you would have fungi to grow from the ground, you must select a spot of light soil on a hill where reeds grow; there you must collect together twigs and other inflammable materials, and set all on fire just before rain is expected; if the rain does not come, you must artificially sprinkle the spot with pure water; but the fungi thus produced are of inferior quality."(120) Every field mycologist knows that certain species of Hymenomycetes, e.g., *Flammula carbonaria*, etc., come up freely on charred spots in woods where fires have been made. Doubtless this fact had been observed by those who sought to raise fungi artificially by burning wood.

FIRE MADE WITH FUNGUS TINDER.

Pliny tells of obtaining fire with the help of dried fungi. He says: "One piece of wood is rubbed against another, and the friction sets them on fire, which is augmented by dry tinder (aridi fomitis), especially by that of fungi and leaves."(121) Doubtless Pliny had in mind tinder like that known commercially as *amadou*, which is made from fruit-bodies of *Fomes fomentarius* and other Polyporei growing on trees in Europe. I find by enquiry that in the East of Canada, about fifty years ago, before the introduction of matches, it was quite usual in country places to make fire with the help of *punkwood*, i.e., very rotten wood rich in the brown mycelium of a fungus which appears to have been *Fomes fomentarius*. I myself have learned the art of making fire in this way. One takes a piece of flint and holds just below one of its sharp edges a small piece of the punkwood. Then one strikes the edge of the flint smartly with a pocket-knife or a small steel file. Sparks are made and soon one falls upon the punkwood, which immediately begins to smoulder. One then judiciously blows on the

(119) Geoponica, *loc. cit.* XII., 31. The translations of this and the next passage quoted were made by Houghton, *loc. cit.*, p. 41

(120) *Ibid.*

(121) Pliny, Nat. Hist., XVI., 77.

punkwood, and places around it some pieces of the shreddy bark of the White Cedar (*Thuja occidentalis* L.). In a few seconds a flame is produced. I have been told by one who regularly used punkwood that he always carried a piece of it with him in a pouch, as it was an admirable means of lighting his pipe. Thus the use of fungi for tinder, instead of rags, by civilised people, has persisted almost to the present day.[122]

The use of amadou for making fire not improbably originated in prehistoric times. The first historical references to the substance appear to be those of Hippocrates in the fifth century B.C. Hippocrates, writing on the practice of medicine, advised cauterization with a fungus for the cure of certain complaints. Thus he says: "One should cauterize the osseous and nervous parts with fungi (*μύκησι*)"; "Quickly cauterize in eight places so as to intercept the extremities of the spleen"; and "When the liver has attained its greatest volume, one should cauterize with fungi."[123] We are left to suppose, in the absence of more precise details, that the cauterization was accomplished by lighting the tinder and applying it, as it smouldered, to the skin on the outside of the affected organ. Possibly it was thought that the blisters so arising would act as a counter-irritant. Such a treatment was probably entirely ineffective. Its drastic nature finds parallels in the cupping, bleeding, and the searing of wounds with a hot iron, to which patients in a bygone age were forced to submit, and which, owing to the progress of medical science, now happily occupy but a very limited sphere in practical therapeutics.[124]

STONE FUNGI.

According to Athenaeus (A.D. 230), Theophrastus, in his Treatise on Plants, says: "In the sea around the Pillars of Hercules, where there is much water, fungi are produced close to the sea, which people say have been turned into stone by the sun."[125] Doubtless the supposed fungi were certain simple corals which from their radiating calcareous plates remind one of the underside of gilled Hymenomycetes. Some of these

(122) The pouch was made of deer-skin leather and was used to prevent the punkwood becoming moist.

(123) For these quotations which I have not yet seen in the original, *vide* Richon et Roze, Atlas des Champignons, Paris, 1888, Part I., p. 3.

(124) Amadou, in the form of thin, brown, very soft sheets, still has one use in medicine: it is employed by some dentists as an absorbent for drying the teeth. In the preparation of amadou, the flesh of the fruit-bodies of *Fomes fomentarius* is cut into slices, dried, and then beaten until it becomes soft. Amadou was sometimes made into caps, chest protectors, and other articles. Dipped into nitre (KNO_3), its inflammability was increased and it was thereby rendered fit for use as tinder (German tinder), in place of charred rags, for making fire with flint and steel before matches came into general use.

(125) Athenaeus, Deipnosoph. II., 61, f.

corals, from their size and appearance, are so reminiscent of Agaricineae that Lamarck called one of the genera *Fungia.* These stony Mushrooms of the sea were introduced into their works by the Herbalists. Thus John Bauhin, in his famous *Historia Plantarum Universalis* of 1650, described and figured them under the heading *Fungi Lapidei.* He says "Fungi arise in the sea just as on the land, but they are not soft, but stony."(126) The true nature of corals long remained unknown, and the mistaken notions of the ancients and of the Herbalists were not corrected until the middle of the eighteenth century, when Peyssonal, a native of Marseilles, observed the living polypes behave as animals, in that, seated upon their skeletal supports, they opened and closed their mouths and extended and withdrew their tentacles.(127)

THE FUNGI KNOWN TO THE ANCIENTS.(128)

Lenz, Roze, Houghton, and others, have discussed the identity of the fungi mentioned by the Greeks and Romans with our modern species. Among the chief conclusions are the following: the *agaricum* corresponds to our *Polyporus officinalis;* the *boletus* to *Amanita caesarea;* the *suillus* to *Boletus edulis;* the ἀμανῖται to the Common Mushroom *(Psalliota campestris);* the *fungi populi* to *Pholiota aegerita;* the *spongioli* to *Morchella esculenta;* the *pezicae* to Puffballs *(Lycoperdon);* and *tubera* to Truffles. Pliny's second best kind of edible fungus, *fungi candidi, velut apice Flaminis insignibus pediculis,* the white fungi whose stalks closely resemble the apex of a Flamen's cap, may have been our *Coprinus comatus.* Other fungi were mentioned as being associated with particular herbs or trees: that connected with the Ferula (Giant Fennel) was *Pleurotus nebrodensis,* and that found upon the Olive may have been *Pleurotus olearius.* Several different kinds of Truffles were known, among which were doubtless *Tuber brumale, Tuber rufum, Tuber Magnatum,* and *Terfezia Leonis.* The Latin word *fungus* was used to denote any kind of fungus. Similarly, the word μύκης (a slimy, sticky thing), from which we derive the first half of our word *mycology,* was the Greek name for fungi in general. In the following list the various identifications which have been made are set out more fully.

(126) J. Bauhin, Historia Plantarum Universalis, 1650, T. 3, p. 801. The *Fungi Lapidei* had previously been mentioned in their works by Caesalpino in 1583 and Colonna (also known as Fabius Columna) in 1606.

(127) Peyssonal, *sec.* L. C. Miall, The Early Naturalists, their Lives and Works, London, 1912, p. 2.

(128) Only the first paragraph of this section was read during the delivery of the Address.

Amanita caesarea Fr.	=	*Boletus* of Pliny and of all the Latin authors. *Βωλίτης* of Galen.
Amanita muscaria Fr.	=	*Boleti veneni, diluto rubore, rancido aspectu, livido intus colore, rimosa stria, pallido per ambitum labro* of Pliny.
Amanita pantherina Fr.	=	*Boleti sicci, nitri similes, veluti guttas in vertice albas ex tunica sua* of Pliny.
Boletus edulis Fr.	=	*Fungi suilli* of Pliny and Martial. *Fungi farnei* of Apicius (?).
Coprinus comatus Fr.	=	*Fungi candidi, velut apice Flaminis insignibus pediculis* of Pliny.
Fomes fomentarius Fr.	=	*Μύκης* of Hippocrates, used for cauterization. *Aridus fomes fungorum* of Pliny.
Lactarius deliciosus Fr.	=	*Fungi tutissimi, qui rubent callo, minus diluto rubore quam boleti* of Pliny.
Lycoperdon Bovista Linn.	=	*Πέζις* of Theophrastus. *Pezicae* of Pliny.
Morchella esculenta Pers.	=	*Spongiae in humore pratorum nascentes* of Pliny. *Sfonduli, Funguli*, or *Spongioli* of Apicius.
Pholiota aegerita Fr.	=	*Fungi populi* of Pliny. Poplar fungi of Dioscorides. *Μύκητες αἰγειρῖται* of the Geoponica.
Pleurotus nebrodensis Fr.	=	*Fungus ferulae* of Pliny.
Pleurotus olearius Fr.	=	Fungi of the Olive of Athenaeus.
Polyporus officinalis Fr.	=	*Agaricum* of Pliny. *Αγαρικόν* of Dioscorides.
Psalliota campestris Fr.	=	*Fungi pratenses* of Horace. *Fungi albi* of Ovid. *Αμανῖται* of Galen.
Puccinia graminis Pers., etc.	=	*Robigo veris* of Pliny, Ovid, etc.
Terfezia Leonis Tul.	=	*Misy* of Pliny and Athenaeus. *Tuber veris* of Juvenal.
Tuber Mich.	=	The general Latin name for Truffle including the *misy* and *ceraunium* of Pliny. *Ὑδνον* of Theophrastus and Greek writers.

Tuber brumale and T. melanospermum Vitt.	=	*Tuber colore nigro* of Pliny.
Tuber Magnatum Pico	=	*Tuber colore intus candido* of Pliny.
Tuber rufum Pico	=	*Tuber colore rufo* of Pliny.

AMANITAE.—In a former section, we have already discussed the identity of the most famous of all the fungi known to the ancients, the *Boletus*, with *Amanita caesarea*. It was shown that it rests chiefly on Pliny's description of the fungus, especially on that part of it where he describes the young fruit-body in one stage of its development as being "like the yolk in an egg"; but that it also rests upon the partial survival of the original name through tradition.(129) We are on less sure ground with *Amanita muscaria* and *Amanita pantherina*. Here again we have to rely on Pliny's descriptions. The former species may have been in Pliny's mind when he spoke of "poisonous kinds" of Boleti, "known by a dilute red colour, a loathsome aspect, and internally by a livid hue" which have "gaping cracks and a pale lip round the margin"; and the latter species may have been included in his "certain kinds" of Boleti "which are dry and like nitre, and which bear on their heads, as it were, white spots formed from their own coating."(130) It may be added that the word *boletus* is supposed to have been derived from the Greek word βῶλος = "a clod," a round mass (= Latin *gleba*), perhaps in allusion to the ball-like form of the young fungus.(131)

BOLETUS EDULIS.—Commentators are generally agreed that the *Fungi suilli* of Pliny and Martial are identical with our *Boletus edulis*. Porta,(132) who lived at Naples, mentions in his *Libri XII. Villae*, published in 1592, an edible fungus which was known locally as *Silli;* and Paulet(133) in 1793 pointed out that in certain parts of France the words *Suillous*, *Siallous*, and *Nissoulous*, had survived as names for our modern species of Boletus. The word *suillus* was derived from *sus*, a pig, and means *something relating to swine*. The Suillus probably obtained its name from the fact that pigs were fond of it. Berkeley(134) states that pigs devour *Boletus edulis* as well as Truffles. The modern Italian name for *Boletus edulis* is

(129) *Vide supra* "The Boletus of the Ancients," p. 45.
(130) *Ibid.* The passage in which these descriptions occur is quoted.
(131) *Cf.* Houghton, *loc. cit.* p. 48.
(132) Porta, Libri XII Villae, cap. LXX., lib. X., reprinted by Clusius in his Brevis Historia Fungorum of 1601, and again by Istvanffi in his work on Clusius in 1900.
(133) Paulet, Traité des Champignones, Paris, Tome I., 1793.
(134) *Sec.* Houghton, *loc. cit.*, p. 32. I cannot find Berkeley's statement.

Porcino,[135] which means *porcine*, and therefore has the same significance as Suillus. That the *Fungi farnei* of Apicius[136] are *Boletus edulis* is merely a matter of conjecture. Pliny,[137] in one passage, speaks of *suilli venenis accommodatissimi.* This is believed by Lenz,[138] Roze,[139] and others, to refer to *Boletus Satanas* and allied poisonous species. On the other hand, the words *venenis accommodatissimi, convenient for poisoning*, have been interpreted by Houghton as being applied to the edible *Boletus edulis*, and he brings forward historical reasons for supposing that Pliny meant to intimate that this harmless fungus had been used as a means of removing Annaeus Serenus by means of a poison introduced into it from without.[140] In this connection it will be remembered that Claudius Cæsar was poisoned through the agency of an edible Boletus *(Amanita caesarea).*[141] Pliny mentions Suilli, along with Boleti, as being "the most recently discovered stimulants of the appetite (gulae novissima irritamenta)."[142] The fungus was therefore held in high esteem as a delicacy. However, the Suillus was not thought to have as good a flavour as the Boletus *(Amanita caesarea)*, for Martial in an Epigram in which he says: "You reserve Boleti for yourself; I am given Suilli (Sunt tibi boleti: fungos ego sumo suillos)," complains to Ponticus that when invited to dinner, his host had not set before him the choicest dainties.[143] The superiority of the ancient Boletus to the Suillus is borne out by the testimony of Paulet, Roques, Vittadini, and others. The *Amanita caesarea* is described by Roques as the finest and most delicate of fungi, whilst Vittadini speaks of it as the most delicious in Italy.[144]

COPRINUS COMATUS.—Pliny's *Fungi candidi, velut apice Flaminis insignibus pediculis* or White Fungi whose stalks closely resemble the apex of a Flamen's cap, which, he said, were safe to eat, have proved very puzzling to commentators.[145] The apex of a Flamen's cap, as may be seen from ancient representations of it, much resembled the spike of a helmet: it was a conico-cylindrical structure, tapering somewhat from below upwards, three or four inches long, and about an inch in diameter at the base. It was made from an olive

(135) *Vide* G. Negri, Atlante dei Principali Funghi commestibili e velenosi, Torino, 1908, p. 78.
(136) *Vide supra,* footnote (7), p. 22.
(137) Pliny, Nat. Hist. XXII., 47.
(138) Lenz, *loc. cit.* p. 760.
(139) Richon et Roze, *loc. cit.* p. XXVI. Roze mentions *Boletus luridus,* etc.
(140) Houghton, *loc. cit.* p. 31.
(141) *Vide supra,* "Edible and Poisonous Fungi," p. 25.
(142) Pliny, Nat. Hist. XVI., 8 (*sec.* Houghton).
(143) Martial, Ep. III., 60.
(144) *Vide* Richon et Roze, *loc. cit.* p. 7.
(145) Pliny, Nat. Hist. XXII., 23, 47.

twig, which was closely wound round with a band of wool. Where it joined the cap, it passed through a horizontal disc which varied in diameter from about 1·5 to 4 inches.[146] Lenz[147] remarks that Pliny, in describing his *Fungi candidi*, was evidently thinking of a fungus which was provided with a delicate ring. Some writers[148] have suggested that Pliny had in mind branched Clavariae, such as *Clavaria Botrytis* and *C. flava;* but this seems to me very unlikely, as these fungi do not resemble the apices either in form or colour. The best conjecture so far made appears to be that of Houghton,[149] who thinks that Pliny's fungus was *Coprinus comatus*. However, Houghton translates Pliny's description as follows: "white fungi whose head-stems are similar in form to the caps of the Flamens." He thus, it seems to me without any good reason, makes *pediculis* refer not to the stipes but to the pilei (head-stems) of the fungi. Houghton says: "Most of the forms of this cap (apex), as shown on coins and bas-reliefs of the Roman emperors, are of a conical or cylindrical form, and remind one of the cylindrical pileus of the very excellent *Coprinus comatus* before it expands and deliquesces; at least I know of no other edible fungus that so much resembles the figure of these priestly caps." Possibly Pliny had in mind the stipes of *Coprinus comatus*, for these are easily detached from their pilei, white, conico-cylindrical, and encircled by a ring. *Coprinus comatus* is one of the commonest species of edible fungi in Europe, and it doubtless came up in the Roman fields in the days of the Emperors. Badham[150] says that in his time (1847) it was largely eaten about Lucca, and Negri[151] has included it in his recent popular work on the chief edible and poisonous fungi of Italy. The fruit-bodies are usually quite free from maggots and, if cooked before the pilei have expanded, possess an excellent flavour. There is no doubt about the safety of this species: it has never been known to poison anybody.[152]

FOMES FOMENTARIUS.—The view that Pliny's *Fomes fungorum* or fungus tinder was a part of the fruit-body of *Fomes fomentarius* from which the amadou of commerce is made, or very rotten wood heavily laden with its mycelium (touchwood), has

(146) A description and illustrations of the apices and caps of the Flamens are given in the article *Flamen*, Dictionnaire des Antiquités Grecques et Romaines, Paris, now in course of publication.

(147) Lenz, *loc. cit.* p. 760.

(148) *Cf.* Roze, *loc. cit.* p. XIII.

(149) Houghton, *loc. cit.* p. 32.

(150) Badham, The Esculent Funguses of England, ed. II., London, 1863 p. 42.

(151) Negri, *loc. cit.* p. 76.

(152) I know its good qualities from personal experience.

already been discussed.[153] Badham, who lived in Italy for some time, writing in 1847, says: "Amadou is largely used in Italy, where it is called *esca;* the Latins likewise knew it by this name, though their more common appellation for it was *fomes;* the Byzantine Greeks hellinized *esca* into *ὕσκα*, which was their word for it; the ancient Greeks called it *ζώπυρον*." He then quotes Salmasius, a French scholar (1588-1653) who wrote a commentary on Pliny: "Salmasius tells us how amadou used to be made in his time, which indeed was the same as now: the fungus was first boiled, then beaten to pieces in a mortar, next hammered out to deprive it of its woody fibres, and lastly, being steeped in a strong solution of nitre, was left to dry in the sun."[154] It is uncertain whether Pliny's fungus tinder was prepared in this way. It is possible that it simply consisted of raw pieces of the flesh of *Fomes fomentarius* or of untreated scraps of touchwood.[155] There is also the possibility that, as a source of tinder, not merely *Fomes fomentarius* but also some other species of Fomes may have been employed.

LACTARIUS DELICIOSUS.—In writing of Fungi as opposed to Boleti, Pliny[156] states that "the safest are those whose skin becomes red but a less dilute red than that of the Boleti." We can only guess what this fungus was, for Pliny has told us nothing more than that it is good to eat and of a red colour. Lenz[157] suggested that the species was either *Russula alutacea* or *Tricholoma Russula*, and he supported the claim of the former by mentioning that, in addition to its being highly regarded as a comestible, it was called (1859) *fungo rossetto* at Verona and *rossola buona di gambo lungo* or *rossola mezzara* in Italy generally. Subsequently Comes examined the Pompeian fresco which shows some fruit-bodies of an Agaric which he identified as *Lactarius deliciosus*. Thereupon he made the suggestion that this species was the red-skinned fungus of Pliny.[158] It is well known that the species of Russula and Lactarius range through many shades of colour and that colour alone is insufficient for their identification. We must therefore consider the problem of the identity of Pliny's safest fungus as unsolved.

LYCOPERDON.—We now come to Lycoperdon. Theophrastus, as we have seen, mentioned a fungus which he called the *Πέζις*,

(153) *Vide supra* "Fire Made with the Help of Dried Fungi," p. 46.
(154) Badham, Esculent Funguses of England, London, ed. I., 1847; ed. II., 1863, p. 22.
(155) Fire can be made with such raw tinder as I have already pointed out, *vide supra* p. 46.
(156) Pliny, Nat. Hist. XXII., 47.
(157) Lenz, *loc. cit.* p. 760.
(158) Comes, *vide supra* "The First Illustration of a Fungus," p. 29.

and stated that it was rootless.[159] Pliny in his Natural History says: "Among fungi there are those called *pezicae* by the Greeks, which grow without root or stalk."[160] There has been a difference of opinion as to the identity of the fungus thus described. Fabius Columna in his *Ekphrasis* of 1606 gave illustrations of two species of Cup-fungi (Discomycetes) and called them *Fungi pezicae* of Pliny. Dillenius,[161] in 1718, altered the name *Pezica* to *Peziza*, and under this form it has survived and is now in use for a well-known genus included in the Ascomycetes. This interpretation was probably erroneous. On general grounds, it may perhaps be urged that it is unlikely that Theophrastus would have mentioned such small and relatively insignificant fungi as our modern Cup-fungi, and that he probably had in mind a fairly large species with some striking characteristic which would make it known to everyone. Lenz[162] and Houghton[163] hold that Pezica was the name given to certain Puff-balls, and with this view the present writer is inclined to concur. Houghton's commentary is as follows: "The Greek forms of *πέζις, ιος* and *πέζιξ, ικος* occur in Theophrastus and Athenaeus. The former says nothing whatever about the *πέζις*, except that it has no root; but Athenaeus quotes Theophrastus as saying that the *πέζις*, together with the *ὕδνον, μύκης*, and *γεῳάνειον*, has a smooth skin, *λειόφλοια*. Lenz[164] in a footnote writes: 'The *πέζις* of Theo-

(159) *Vide supra* "The Dawn of Mycology," p. 27.
(160) Pliny, Nat. Hist., XIX., 3.
(161) Dillenius, Catalogus Plantarum circa Gissam Sponte nascentium, Francofurti, 1718, p. 194.
(162) Lenz, *loc. cit.* p. 755.
(163) Houghton, *loc. cit.* p. 35.
(164) Lenz, *loc. cit.* p. 755. Lenz mentions *peto* as well as *vescia*.
(164A) The Greek name *πέζις* is derived from *πέζα*, "the foot," "bottom," "base," that which rests on its base, "sessile" (*sec.* Houghton, *loc. cit.* p. 48). The most striking feature about a Puffball to the casual observer is that when a ripe one is pressed with the fingers, it puffs usually from an aperture at the top: a jet of air is expelled containing a cloud of brown dust which is unpleasant for the eyes, nose, and throat. On this account the Puffball, on the continent of Europe, was given a popular but very vulgar name. This was translated by the early commentators on Dioscorides (e.g. Ruelle 1536) into the Latin *Crepitus lupi*. Concerning the nomenclature of the Puffball, Henri Fabri (Life of the Fly, Translation, Toronto, 1913, pp. 397-398) makes the following amusing comments: "Ennobled by Latin which provided me with my first exercises and translations, glorified by the ancient language which the rector used in saying his mass, the mushroom rose in my esteem. To deserve so learned an appellation, it must possess a genuine importance. The same books told me the name of one that had amused me so much with its smoking chimney. It is called the puffball in English, but the French name is the *vesse-de-loup*. I disliked the expression, which to my mind smacked of bad company. Next to it was a more decent denomination: *Lycoperdon;* but this was only so in appearance, for Greek roots sooner or later taught me that *Lycoperdon* means *vesse-de-loup* and nothing else. The history of plants abounds in terms which it is not

phrastus and the *pezica* of Pliny are without doubt the *bovista* (die Boviste).' He compares the modern Italian name *vescia*, both in sound and meaning, with the Greek πέζις. The λειόφλοια of Theophrastus would seem to point to the smooth-skinned *Lycoperdon giganteum (L. Bovista* L.)."[164A]

MORCHELLA ESCULENTA.—Pliny says: "And we shall call fleshy things (carnosa) certain other vegetables such as *Sponges* which grow in the wet places of meadows (ut *spongias* in humore pratorum enascentes)," and then he adds that he has spoken of Fungi and Tubera already.[165] Apicius, the writer on Roman cookery, gives recipes for the preparation of four sorts of fungi, of which one is called *Sfonduli, Funguli* or *Spongioli*.[166] It has been supposed that the *Spongiae* of Pliny and the *Spongioli* of Apicius were names for *Morchella esculenta* and allied species.[167] There can be little doubt that the Spongiolus of Apicius was a common fungus, well known, and held in high repute as a comestible, for, if this had not been so, it is unlikely that Apicius would have given several recipes for its preparation. Such a fungus is *Morchella esculenta* at the present day. Then, too, the ancient name of *Sponge* for a particular kind of fungus has survived. In 1592, as we learn from the Neapolitan Porta,[168] one of the edible fungi coming up in spring in Southern Italy was called *Spongiole* owing to its resemblance to a sponge. At the present day, the Italians call the genus Morchella by the name of *Spugnola* (Spugna = sponge). The *Morchella esculenta*, which like Porta's Spongiole appears in spring,[169] is *Spugnola gialla*. It seems altogether likely that the modern fungi called Sponges and the ancient ones which bore the same name, are identical. Assuming this to be the case, we are justified in supposing that the Spongioli of Apicius and perhaps also the

always desirable to translate. Bequeathed to us by earlier ages less reticent than ours, botany has often retained the brutal frankness of words that set propriety at defiance." The old *Bubenfist* or *Boviste* of the Germans (*Bube* = boy, knave, etc.), which was the name given to the Puffball, doubtless arose in a similar manner to *vesse-de-loup*. The name *Lycoperdon* was invented by Tournefort and published in his *Institutiones Rei Herbariae* in the year 1700.

(165) Pliny, Nat. Hist. XIX., 22. (*Sec.* Richon et Roze, p. XVII.).

(166) Apicius, De Arte Coquinaria. *Vide supra* p. 22, (7).

(167) *Cf.* Roze, *loc. cit.* p. XXVI., for the Spongiae of Pliny; Houghton, *loc. cit.* p. 47, for the Spongioli of Apicius 22, (7).

(168) Porta, Libri XII Villae, 1592, *loc. cit.* The Morchella pileus, with its numerous deep surface cavities, is the part which is reminiscent of certain bath-sponges.

(169) *Vide* G. Negri, Atlante dei Principali Funghi commestiblili e velenosi, Torino, 1908, pp. 92-96. The Helvellae as well as the Morchellae are called in Italy by the name of Spugnola.

Spongiae of Pliny were names applied to *Morchella esculenta* and its allies.[170]

PHOLIOTA AEGERITA.—An edible fungus which grew on Poplar trees, was mentioned by Pliny, by Dioscorides, and in the Geoponica. Pliny says: "There are three kinds of Poplar: the Black Poplar, the White Poplar, and one called the Libyan with very small leaves, which is very dark and very highly valued on account of the fungi which it produces."[171] Dioscorides and the Geoponica tell us how the fungus may be cultivated on pieces of Poplar wood.[172] The fruit-bodies were referred to by Pliny as *Fungi populi*, and in the Geoponica as *μύκητες αἰγειρῖται*. Porta, in 1592, mentions the *Aegeritae* as fungi which can be grown on wood in the manner described by the ancients.[173] What then was the fungus of antiquity which grew on Poplars and was held in such high favour as a table delicacy? In all probability it was *Pholiota aegerita*, a well-flavoured species which grows on Poplar trees in Southern Europe at the present day. Henri Fabre,[174] who lived in the very South of France, describes this species from personal experience as "one of our best mushrooms, despite its colour of a doubtful white, its skin which is often wrinkled, and its gills soiled with rusty brown by the spores." His praise matches that implied in the writings of the Greeks and Romans. The cultivation of the Poplar fungus took place as late as the nineteenth century. Badham,[175] in 1847, tells us that, in the Botanical Gardens of Naples, he saw a row of pollarded heads of Black Poplar trees *(Populus nigra* var. *Neapolitana)*, which were bearing an edible fungus, and stated that it was the custom to keep such heads for years for the purpose of obtaining the fungi which they yielded. Cordier,[176] in 1876, mentions that Deveaux grew an edible fungus on sections of a Poplar trunk which were 3 to 4 cm. thick and had been placed in the soil. Badham called his fungus *Agaricus caudicinus*, and Deveaux his *Agaricus attenuatus* DC. var. *cylindricus* Fr. These may have been mistakes in nomenclature. The general consensus of opinion (Fries,[177]

(170) Pliny does not say that his Spongia is edible. He simply tells us that it is fleshy and grows in wet spots in meadows. It is possible that for him the name Sponge may have had a somewhat different significance to that which it had for Apicius and which it has now. In this connection it should be mentioned that in Germany the fleshy fungi generally are all known by the name of *Schwämme* (Sponges).

(171) Pliny, Nat. Hist. XVI., 35.

(172) *Vide supra* "The Cultivation of Fungi," p. 46.

(173) Porta, Libri XII Villae, lib. X., cap. LXX., Reprinted in Istvanffi's Clusius.

(174) Henri Fabre, *loc. cit.* p. 405 (1913).

(175) Badham, Esculent Funguses of England, ed. I., 1847, ed. II., 1863, p. 50

(176) F. S. Cordier, Les Champignons de la France, Paris, 1870, p. 99.

(177) Fries, Epicrisis Systematis Mycologici, Upsaliae, 1836-1838, p. 164.

Roze,[178] Houghton,[179] etc.) is that the ancient and modern Poplar fungus is *Pholiota aegerita* Fr.[180]

PLEUROTUS NEBRODENSIS.—Pliny speaks of the fungi associated with certain trees as follows: "Some persons have discriminated the kinds of fungi (edible and poisonous) from the kinds of trees on which they grow, such as those found on the Fig, the Giant Fennel, and gummiferous trees. We have already spoken of those which are produced on the Beech, the Oak, or the Cypress."[181] The Giant Fennel is one of the tallest species in the Umbelliferae and is found in Southern Europe. Pliny's name for it was *Ferula*, which it bears in Southern Italy to this day.[182] Linnaeus called the species *Ferula communis*.[183] In France its common name is *la Férule*. The *Fungus ferula* of Pliny has been identified by Roze as *Pleurotus nebrodensis* Fr. This commentator says: "Another fungus mentioned by Pliny, and concerning which there is no uncertainty, is that of the Giant Fennel *(Pleurotus nebrodensis)*, which is still very much liked in our time in Italy and Algeria."[184] Fries[185] mentions that, at the present day, this species grows on the roots of Umbelliferae in Sicily and under *Ferula communis* in Cyprus.

PLEUROTUS OLEARIUS.—Athenaeus quotes Nicander as saying in his Georgics, a lost work, that the fungi of the Olive, the Pomegranate (?), and the Holm-oak, are vegetable excretions, enemies of the human body, clammy choking lumps which are mortal in their effects.[186] What were the fungi on the Pomegranate and the Holm-oak it is difficult to guess, but that on the Olive is believed by Roze[187] and others to be *Pleurotus olearius* DC. This species grows on Olive trees in Southern Europe at the present day, but not exclusively thereon, for Henri Fabre,[188] who lived in the South of France, says: "Its popular name (the olive-tree agaric) is not very appropriate. True, it frequently grows at the base of old olive-trees, but I also pick it at the foot of the box, the holm-

(178) Roze, *loc. cit.* p. XIV.
(179) Houghton, *loc. cit.* p. 42.
(180) Lenz (*loc. cit.* p. 764) called the Poplar fungus *Agaricus mutabilis*. Probably, like Badham and Deveaux, he erred in his identification.
(181) Pliny, Nat. Hist. XXII., 47.
(182) Lenz, *loc. cit.* p. 563. Houghton (*loc. cit.* p. 31) translated *ferula* as Birch. This is an error. The Birch does not grow in Greece, and in North Italy it is found only on the sides of tall mountains. Pliny called it *betulla* and said that it preferred a cold habitat and was really a Gallic tree (Lenz, *loc. cit.* p. 392).
(183) Linnaeus, Species Plantarum, ed. III., p. 355.
(184) Roze, *loc. cit.* p. XIII.
(185) Fries, Hymenomycetes Europaei, Upsaliae, 1874, p. 171.
(186) Athenaeus, Deipnosoph. II. (*sec.* Roze and Houghton).
(187) Roze, *loc. cit.* p. XXVI.
(188) Henri Fabre, *loc. cit.* p. 418.

oak, the plum-tree, the cypress, the almond-tree, the Guelder-rose, and other trees and shrubs. It seems fairly indifferent to the nature of its support." Fabre describes the fungus as "a magnificent mushroom, coloured jujube-red." Its striking appearance must therefore have attracted attention to it in antiquity just as at the present day. Further, it is undoubtedly very poisonous, for, on this point the united observations of Micheli, Cordier, Destrems, Mierge, Planchon, and Réguis, leave no doubt whatsoever.[189] The identification of the Olive fungus of Nicander with *Pleurotus olearius*, therefore, may well be a correct one.

POLYPORUS OFFICINALIS.—The *Agaricum*, as we have already seen, was a fungus which was described by Dioscorides and held by him in high favour on account of its medicinal properties.[190] It was also recommended by later writers such as Galen and Pliny. There can be no doubt that the Agaricum is identical with our *Polyporous officinalis* Fr. (= *Fomes officinalis* = *Fomes Laricis*).[191] Both grow on trees, and both have a peculiar taste and a strong purgative action. Moreover, as we learn from Harduin,[192] in the mountains of the province of Dauphiné, in the East of France, the ancient name of Agaricum for *Polyporus officinalis* has survived by tradition. The fungus has continued in use in medicine from the time of the Greeks and Romans almost to the present day.[193] Dioscorides tells us that the Agaricum grows in Agaria of Sarmatia. It therefore appears that its name was derived from the locality in which it was procured. Sarmatia was part of Russia, so that the Agaricum was brought to Greece and Italy from a considerable distance. Sprengel, commenting on Dioscorides, wonders at this, for he points out that the Romans could easily have obtained the fungus from Rhaetia, Vindelicia, and Noricum, provinces on the Danube, much nearer home than the far-off Agaria. "Still," he remarks, "even in our time (1818) agaricum, which Europeans consider a most excellent kind, is sent from the remote Ural mountains as well as from Syria."[194] Houghton[195] explains the import of the fungus from Sarmatia as follows. The promontory of Agarum was the country of the Agari, a people skilled in medicine and said to have been able to cure wounds with ser-

(189) *Vide* Roze, *loc cit.* p. 153.
(190) *Vide supra* pp. 33, 35, on "The Sexes of Agaricum" and "The Medicinal Properties of Fungi."
(191) For a list of synonyms *vide supra*, footnote (63), p. 34.
(192) Harduin, *sec.* Lenz, *loc. cit.* p. 758.
(193) *Vide supra* "The Medicinal Properties of Fungi," p. 35.
(194) Sprengel, Geschichte der Botanik, Altenburg und Leipzig, Vol. II., 1818, p. 490 (*sec.* Houghton, *loc. cit.* p. 27).
(195) Houghton, *loc. cit.* p. 28.

pent's venom. Some of the Agari attended Mithridates the Great as physicians. Hence a special value would be attached to Agaricum procured from such a renowned district.

The Agaricum is treated of in the all-embracing Natural History of Pliny, and it is included in the materia medica of Galen. Pliny in one passage writes as follows: "The Agaricum grows like a fungus on trees around the Bosphorus: it is of a white colour; it is given in four-obol doses mixed with two cyathi of honey and vinegar. That which grows in Gaul is considered of an inferior kind. The male is thicker and more bitter than the female; it cures headaches; the female, which is of looser texture, is at first sweet to the taste and as it is swallowed it leaves a bitter taste."(196) The white colour is correct for *Polyporus officinalis*. As for the rest of the description, part of it at least may have been taken from Dioscorides. In another passage Pliny says: "The acorn-bearing trees (arbores glandiferae) of the Gallic provinces more particularly produce Agaricum; it is a white fungus with a strong odour, useful as an antidote; it grows on the tops of trees and shines at night; by the help of this light its presence is made known and it is gathered."(197) Here Pliny seems to have been the victim of incorrect information obtained at second hand. It is true that in the East of France, among the mountains, where, as already mentioned, the ancient name has survived, the Agaricum is very common; but it never grows on the Oak, always on the Larch.(198) It is also true that the fungus is white, has a strong odour, and possesses medicinal properties; but the statement that "it grows at the tops of trees and shines at night, by which fact its presence is known and it is gathered," is quite erroneous. There is no evidence that the fruit-bodies of *Polyporus officinalis* emit light. However, there is a tree-fungus which grows in the South of Europe, including Italy, which has long been known to be distinctly phosphorescent, namely, *Pleurotus olearius* DC. The fruit-bodies of this species do indeed shine at night, as Battarra first noticed in 1755. Confirmation of the fact has been given by De Candolle, Delile, and Tulasne.(199) However, the glow, according to Henri Fabre, who observed it in the South of France, "is exceedingly faint, so much so that it is not perceptible except in the deepest darkness."(200) In a preceding paragraph grounds have been given for the belief that

(196) Pliny, Nat. Hist. XXV., 9. The male and female kinds of Agaricum were discussed in a previous section on "The Agaricum."
(197) *Ibid.* XVI., 8.
(198) Chorier, Hist. Delph. I., 1, p. 58 (*sec.* Lenz, *loc. cit.* p. 758).
(199) For a resumé of the history of this subject *cf.* Hans Molisch, Leuchtende Pflanzen, Jena, 1904, p. 30.
(200) Henri Fabre, *loc. cit.* p. 418.

Pleurotus olearius was known to the ancients as the Olive-tree fungus. It is therefore a possibility that Pliny, when stating that the Agaricum shines at night, was in reality, owing to a confusion of species, referring to the remarkable phenomenon of phosphorescence of the fruit-bodies of *Pleurotus olearius*.[201]

PSALLIOTA CAMPESTRIS.—There can be no doubt that the Common Mushroom *(Psalliota campestris)* was known to the ancients, as to-day it is of frequent occurrence in the fields of Italy and Greece, where it is highly esteemed on account of its delicious flavour and its perfect innocuity.[202] Horace[203] probably had it in mind when he said: "Fungi which grow in meadows are the best; it is not well to trust others *(Pratensibus* optima *fungis* Natura est; aliis male creditur)." It seems likely, too, that Ovid[204] was also making a reference to it when he described a frugal peasant woman in her daily work as sweeping out the cottage, setting hens on eggs, and gathering green mallows and white fungi (Aut virides malvas aut *fungos* colligit *albos*). The modern Italian name of the Mushroom is *Prataiuolo*,[205] which at once suggests the *Fungi pratenses* of Horace.

There seem to be good grounds for believing that the Amanita *(Αμανῖται)*, a Greek name first used by Galen,[206] was the usual appellation in ancient Greece for the Common Mushroom. Houghton[207] and Roze[208] are in agreement on this point. The latter says: "Support for this opinion is given by the fact which was determined by Krombholz and has kindly been confirmed for me by M. Gennadius, Inspector of Agriculture in Greece, that in the present Greek language our wild Mushroom, which is gathered in abundance after rain in all pastures, is called by the name of Manitari *(Μανιτάρι)*. To-day, all the edible Mushrooms are called in Greece Manitaria *(Μανιτάρια)*. This word, which is the equivalent of the French word *champignons*, is derived in all probability from the mountain Amanon *(Αμανον)* in Cilicia, whence *Αμανον = Αμανίτα = Μανιτάρι*. Some specimens of fungi which in Greece bear this name more especially, and which, in the most obliging manner, have been sent to me by M. Gennadius,

(201) Fries (Hymenomycetes Europaei, 1874, p. 170) says concerning *Pleurotus olearius*: "Lamellarum *phosphorescentia* maxime insignis et antiquitus celebratus." I presume that in the last phrase he was referring to the passage from Pliny which has just been discussed.

(202) For Italy *vide* G. Negri. Atlante dei Principali Funghi commestibili e velenosi, Torino, 1908, p. 72.

(203) Horace, Sat. II., 4, 20-21.

(204) Ovid, Fast. IV., 697.

(205) Negri, *loc. cit.*

(206) Galen, De Aliment. Facult. lib. II., 69.

(207) Houghton, *loc. cit.* p. 48.

(208) Roze, *loc. cit.* p. XXIII.

allow me to state that the name is certainly applied to our Common Mushroom *(Psalliota campestris)*." This identification of the ancient Amanita with *Psalliota campestris* fits in well with Galen's recommendation[209] that people should not eat any other species of fungi than the Boletus *(Amanita caesarea)* and the Amanita, for we know that the Common Mushroom is perfectly wholesome.[210]

PUCCINIA GRAMINIS, etc.—The *Robigo* or Rust of cereals was mentioned, as we have already seen, by a number of ancient authors, and interesting particulars were given concerning it by Pliny and Ovid.[211] The red spots and streaks which the Romans saw on the leaves and haulms of their Wheat, Rye, Oats, and Barley, must have been the uredospore-pustules of various species of *Puccinia*, e.g., *Puccinia graminis*, *P. dispersa*, *P. glumarum*, *P. coronata*, etc., which commonly occur at the present day in Europe. One kind of Rust fungus which was observed to make its appearance early in the year was called by De Candolle *Puccinia Rubigo-vera*. In 1894, Eriksson and Henning showed that this is a collective species, and they split it up into the Yellow Rust, *Puccinia glumarum*, and the Brown Rust, *Puccinia dispersa*.[212] Hence the specific name *Rubigo-vera*, which was reminiscent of the Robigalia festival of the Romans, has been discarded.

TRUFFLES.—The Greeks and Romans were fond of Truffles and certainly knew several different kinds, as is shown by several passages already quoted from the writings of Pliny, Theophrastus, Plutarch, and Juvenal.[213] Theophrastus was the first to mention these subterranean fungi. He speaks of the *ὕδνον*, which some call *ἄσχιον*, and the *οὔϊγγον*, and other such subterranean things, as having no root.[214] In another passage,[215] he says that the *ὕδνον* is sometimes called *μίον*, that it is very sweet with a fleshy odour; and that in Thrace it is called *ἴτον*. Then he tells of the popular belief that Truffles are produced by thunderstorms, and of certain localities in which they are found. Dioscorides[216] calls the *ὕδνον* a root, and says that it is roundish, without leaves and stem, inclining

(209) Galen, *loc. cit.* Also *vide supra* "Edible and Poisonous Fungi," p. 26.
(210) Another possible reference to *Psalliota campestris* is to be found in the remark of Theophrastus (*circa* 300 B.C.) that the fungi (*μύκητες*) which grow on dung have no bad smell. *Vide supra*, p. 27.
(211) *Vide supra* "The Rust Disease," p. 30.
(212) J. Eriksson and Ernst Henning, Die Hauptresultate einer neuen Untersuchung über die Getreideroste. Zeitschrift für Pflanzenkrankheiten, Bd. IV., 1894, pp. 197 and 257.
(213) *Vide supra*, "The Origin of Fungi," p. 31.
(214) Theophrastus, Hist. Plant. I., 6, §9, ed. Schneider, *sec.* Houghton.
(215) *Ibid.* I., 6, §13. *Vide supra* "The Origin of Fungi," where the passage is quoted in full.
(216) Dioscorides, Mat. Med. II., 174, *sec.* Houghton.

to yellow; that it is dug out of the ground in the spring, and is eaten either raw or cooked.

Houghton[217] makes the following comments on the Greek names for Truffles: "With respect to the Greek words *ὕδνον*, *ἄσχιον*, and the Thracian *ἴτον*, and the *μίσυ*, the name of the plant near Cyrene, there is no clear etymology forthcoming. If *οἴδνον* is another form of *ὕδνον*, according to Liddell and Scott's Lexicon (but I can find no authority for its use in Theophrastus), then one would naturally refer the name to *οἰδέω* or *οἰδάνω*, "to swell," and the etymology would be sufficiently exact, answering to the Latin *tuber*. Aëtius and later Greek writers use the word *ἴτνον* for the truffle. Sibthorpe found the names *ὕδνος* and *ἴκνος* to denote this fungus in Greece, and Heldreich (Die Nutzplanzen Griechenlands, p. 2) gives *ὕδανον* or *ὕδνον* for the *Tuber cibarium* in the Peloponnesus, and *χοιροόψωμα* in Crete, adding that Truffles occur in woody places in Greece, but are not much sought after. According to the last-named authority, the ancient Greek name *ἄσχιον* for a Truffle is now used for a polyporus or a fungus generally, under the form of *ἴσκα*, Pelasg. *eské*, *éska*. The *μίσυ* must remain quite unexplained. Another Greek name is apparently used by Theophrastus to signify a Truffle, viz. *κεραύνιον*, but given by Athenaeus, who is quoting Theophrastus, as *γεράνειον*. I suspect *κεραύνιον* is the proper reading, and that it refers to the popular idea that such plants appeared chiefly after thunderstorms."

We have seen that Pliny[218] considered Truffles to be one of the marvels of nature because "they spring up and live without a root," and that he termed them an imperfection of the earth (vitium terrae). Concerning the different species he says: "There are two kinds; one is sandy and injures the teeth, the other is without any foreign matter (sincera); they are distinguished by their colours being red, or black, or white within; those of Africa are most esteemed." To the passage containing these words, which has already been quoted,[219] he added the following remarks: "The following accident happened a few years ago to Lartius Licinius, a person of praetorian rank, and a minister of justice at Carthage, in Spain, as I myself know: he was biting a Truffle and a denarius inside it bent his front teeth, from which circumstance it is evident that this natural production of the soil had originally assumed a globular shape, as is the case with those things which grow of themselves and are not able to arise from seed. Of a similar nature is that which is produced in the province of

(217) Houghton, Notices of Fungi in Greek and Latin Authors, *loc. cit.* p. 43.
(218) Pliny, Nat. Hist. XIX., 11. *Vide supra* "The Origin of Fungi," p. 31.
(219) *Ibid*

Cyrenaica called *misy;* it is noted for the sweetness of its smell and flavour, and is more fleshy than the other kinds mentioned; that which is called *ceraunium* in Thrace, is of a similar nature." Finally he repeats what Theophrastus has said concerning the popular belief that Truffles are formed during thunderstorms and states that the best kind is obtained in spring.

From Pliny's remarks one gathers that *tuber* was the general name for Truffles, and that the *misy* and the *ceraunium* (mentioned first by Theophrastus) were particular kinds of Truffles. Tulasne[220] justly remarks that the species which was gathered in the spring, the *tuber veris* of Juvenal and others, is doubtless the *Terfezia Leonis* Tul. or *Terfez* of the Arabs, which grows in North Africa. In this connection, it will be remembered that Pliny says: "Those of Africa are most esteemed." Tulasne noticed that the surface of the base of the fruit-bodies of *Terfezia Leonis* often bristles with sand, which also gets into their substance.[221] Here again Pliny's words are brought to mind: "One kind is sandy and injures the teeth." For the other species, we have only the colour for a guide and the statement by Theophrastus that one at least was produced during autumn rains. It seems very likely, as Roze[222] suggests, that Pliny's Black Truffle *(Tuber colore nigro)* included such species as *Tuber brumale* and *T. melanospermum*, that his White Truffle *(Tuber colore intus candido)* may have been *Tuber Magnatum*, and that his Red Truffle *(Tuber colore rufo)* may have been *Tuber rufum*. Bicknell[223] states that he often noticed Truffles in the markets of Northern Italy, and that one of them was sold as *Tartufi bianchi* (White Truffles) at Bologna at four francs per pound. This highly esteemed species he identified as *Tuber Magnatum* Pico.

There can be no doubt that Truffles were considered by the ancients as among the most delicious of all fungi. The excellence of the North African *Terfezia Leonis* was celebrated by Juvenal[224] in some lines of a Satire which describe a stage in an elaborate feast, and which Houghton has translated as follows:—

"Then if the spring its genial influence shed,
And welcome thunders call them from their bed,
Large Truffles enter; ravish'd with their size,
'O Libya, keep your grain!' Alledius cries,
'O bid your oxen to your stalls retreat,
Nor, while you boast such Truffles, think of wheat!'"

(220) Tulasne, Fungi Hypogaei, Paris, 1851, p. 160 (*sec.* Roze).
(221) *Ibid* (*sec.* Houghton, *loc. cit.* p. 155).
(222) Roze, *loc. cit.* p. XXVI.
(223) Bicknell, Notes on the Edible Fungi of Italy, Woolhope Club Transactions, 1884.
(224) Juvenal, Sat. V., 116-119; Houghton, *loc. cit.* p. 46.

Martial[225] held that the Truffle was only slightly inferior to the lordly Boletus *(Amanita caesarea)*. In an Epigram he makes some Truffles exclaim: "We who, with tender head, burst through the earth that nourishes us, are Truffles, a fruit second only to Boleti":

"Rumpimus altricem tenero quae vertice terram
Tubera, boletis poma secunda sumus."

Galen,[226] the medical man, expressed himself in very much the same manner upon Truffles as he did on other fungi. He grudgingly admitted that they are good to eat but gave them no praise. He says that Truffles must be considered to be roots or bulbs; that they possess little flavour, should be eaten with spices, and are harmless; and that they possess a thick but not a noxious juice.

OTHER SPECIES.—Doubtless, in addition to the fungi which have been enumerated above, the old Greeks and Romans knew a number of other species which, however, did not possess sufficiently striking qualities to cause authors to mention them. Among the unrecorded species may have been: *Marasmius oreades*, *Cantharellus cibarius*, *Fistulina hepatica*, *Polyporus intybaceus*, *Hydnum repandum*, various species of *Russula* and *Lactarius*, etc. These are eaten in Italy at the present day and may also have been used as food in the time of the Roman Emperors.[227]

THE MISUSE OF CLASSICAL NAMES BY LINNAEUS.

Linnaeus was chiefly interested in the Flowering Plants and took but little interest in Fungi. He called them "beggars,"[228] "thievish and voracious,"[229] and said that "they seize upon the odds and ends which plants leave behind them when Flora is leading them into their winter quarters."[230] In the most

(225) Martial, Ep. XIII., 50.

(226) Galen, De Aliment. Facult. II., 68 and elsewhere (*sec.* Houghton, *loc. cit.* p. 46).

(227) Ovid, in one passage (Met. VII., 392-3), says: "Here (in Corinth) the ancients record that in the first age of the world mortal bodies were produced from fungi which spring up after rains":

"Hic aevo veteres mortalia primo
Corpora vulgarunt pluvialibus edita fungis."

Houghton (*loc. cit.* p. 25) suggests the fungus which originated this myth in the following words: "Considering the licentious nature of the people and the extent to which the worship of Aphrodite prevailed in the city of Corinth, which in all probability was introduced by the Phœnicians, is it possible that the *Phallus impudicus* suggested the mythological tradition?" It is certainly conceivable.

(228) Linnaeus, "Fungi vero Mendici," Amoen. Acad., ed. 1, Vol. VII., 1769, p. 370.

(229) & (230) Linnaeus, "furaces voraces. Hi Flora reducente Plantas hiematum, legunt relictas earum quisquilias sordesque," Syst. Veget., ed. XIII., s. Murreana, 1774, p. 3.

arbitrary manner the great systematist, towards the middle of the eighteenth century, misapplied the fungus names which were then existing.[231] He wrongfully took ὕδνον, which was the Greek name for a Truffle, and used it for the genus *Hydnum* to denote fungi with a toothed hymenium. The word *agaricum*, as we have seen, was the ancient name for a species of Polyporus which grows on trees, namely, *Polyporus officinalis*. Linnaeus took the word Agaricus and applied it to designate fungi whose hymenial surface is lamellose. From Pliny's description of the *boletus*, there can be no doubt that this name was originally used for one or more species of what we now call *Amanita*, i.e., a genus provided with gills; yet Linnaeus, following Dillenius and discarding the correct *suillus* of Micheli, applied the name Boletus to fungi whose hymenium consists of tubes. Finally, the word *helvella* which Cicero[232] used apparently to denote some dainty product of the earth which may or may not have been a fungus, without any good reason was used by Linnaeus for the genus which now bears its name. All these errors in nomenclature persist to the present day. Fortunately respect for priority does not extend to the times of the Greeks and Romans, so that we are not called upon to alter names which are now universally established.

Since the time of Linnaeus, Paulet alone has attempted to correct the mistakes which Linnaeus made in the use of the words Agaricus and Boletus. For *Agaricus* L. Paulet, in 1812, in his *Traité des Champignons*, substituted *Hypophyllum*, and for what we now, following Linnaeus, call *Boletus* he substituted *Tubiporus*.[233] Although these new names were well constructed, and from the descriptive point of view accurate, they were not accepted by other mycologists. This was doubtless due to the belief that, as the authority of Linnaeus was so great and his terminology so well established, any attempt to make a change would only lead to confusion.

(231) Linnaeus, Genera Plantarum, ed. I., 1737; ed. VI., 1764.

(232) Cicero, Ep. ad Fam., VII., 26.

(233) Paulet, Traité des Champignons, Paris, 1793. The names *Hypophyllum*, *Tubiporus*, etc., were not given in the text, but in the large Atlas which accompanied it and which was issued about 1812. This Atlas was published during a turbulent time in French history, and is very scarce: I have not seen it. In the second edition of the Atlas published by Léveillé (Paulet et Léveillé, Iconographie des Champignons, Paris, 1855) Paulet's specific names are set upon the plates. A synonymy of the names of Paulet and Fries is given by Laplanche, Dictionnaire Iconographique des Champignons Supérieurs, Paris, 1894, pp. 428-457.

CONCLUSION.

We have now come to an end of this first chapter in the history of Mycology. We have seen that the Greeks and Romans were familiar with a good many kinds of edible and poisonous fungi, that the Romans in particular developed elaborate recipes for cooking the most desirable species, that means were taken for dealing with cases of accidental poisoning, and that certain fungi had been discovered to possess medicinal properties. On the other hand, so far as the origin and mode of reproduction of fungi are concerned, the ancients were in complete ignorance. In general, they were contented to accept a theory of spontaneous generation, and they never even suspected that fungus fruit-bodies are simply reproductive organs. The spore dust, except doubtless in the Puffballs, appears to have entirely escaped observation.